

DEPARTMENT OF THE INTERIOR

---

ANNUAL REPORT

OF THE

TOPOGRAPHICAL SURVEYS  
BRANCH

1919-20

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OTTAWA  
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PRINTER TO THE KING'S MOST EXCELLENT MAJESTY  
1921







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# REPORT OF THE TOPOGRAPHICAL SURVEYS BRANCH

## PART I—FIELD WORK

The surveys appropriation, which before the war was over a million dollars, was only seven hundred thousand dollars for the year 1919-20. Because of the high prices that prevailed this sum represented less than half the pre-war expenditure.

Forty-eight survey parties were employed in the field during the year, being an increase of twelve over the previous year. Of the forty-eight parties, fourteen were employed partly in one province and partly in another, five were employed exclusively in Manitoba, fourteen in Saskatchewan, thirteen in Alberta, and two in British Columbia.

The survey of base lines and meridians, the governing lines of the Dominion Lands Survey System, was sufficiently far in advance of settlement to make it possible to postpone further work of this kind and no party was employed on such surveys.

The number of parties on subdivision surveys was increased from one to eight to meet the requirements of the Soldier Settlement Board in connection with their plans for establishing returned men on the land. Large tracts of land were withdrawn from the Porcupine and Pasquia forest reserves and when subdivided were thrown open for homestead, entry being restricted to returned soldiers. In addition to the eight parties already referred to, necessary subdivision in the railway belt of British Columbia to keep pace with settlement was attended to by two parties, being one less than formerly employed on this work.

At the request of the Soldier Settlement Board the number of parties locating land suitable for the settlement of returned veterans was increased, four parties being employed wholly upon this work.

One party was located in the Peace River district, one north of Edmonton, one in Pasquia and Porcupine forest reserves, and one east of Dauphin, Man.

Complete information as to the topography of the country is necessary for its economic development. In the older settled districts the information in the possession of the department is obsolete and incomplete. To supplement this information four parties were employed, one in the vicinity of Winnipeg, one near Saskatoon, another near Calgary, and a fourth around Edmonton. From the information gathered by these parties combined with that available from local and other sources, complete topographical maps of the districts are being prepared.

## SUBDIVISION SURVEYS

The greater part of the subdivision work undertaken this year was in connection with the requirements of the Soldier Settlement Board.

The largest area surveyed was one which formerly comprised portions of the Pasquia and Porcupine forest reserves, and which had become so denuded of timber by yearly forest fires and by the cutting of cordwood by the settlers in the vicinity,



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that after investigation by survey parties engaged on land classification it was recommended for subdivision.

Work in other areas, notably that in the Peace River district of northern Alberta, was undertaken for the benefit of squatters, who could not proceed with any permanent improvements until the boundaries of their holdings had been defined.

It was therefore found necessary to employ eight survey parties on subdivision as compared with one party during the previous season.

*Party No. 1—Surveys along Hudson Bay Railway and Northwest of Prince Albert*

This party commenced work in the field on June 18, being delayed by the strike in Winnipeg where supplies and transport equipment were purchased but could not be forwarded sooner by the railways.

PERSONNEL:

S. L. Evans, D.L.S., in charge.

Assistants—

F. H. Wrong, D.L.S.  
L. S. MacDonald.

Party—

Ten employees.

The first work was carried on along the Hudson Bay railway in tps. 62 and 63, ranges 16 to 18, west of the Principal meridian. The survey was continued in this district up to July 28, when the party was moved to Shellbrook to undertake surveys urgently required by the Soldier Settlement Board. This work comprised the subdivision of the surrendered portions of Mistawasis, Big River, and Muskeg Indian reserves, in northern Saskatchewan.

On completion of the subdivision of part of Muskeg Indian reserve on December 26, operations in the field were closed for the season and the party paid off.

*Party No. 2—Surveys near Prairie River, Saskatchewan*

The subdivision done by this party lay in the area withdrawn from the Porcupine forest reserve, as it contained large patches of good land recently burnt over and easy to clear. Homestead entry, however, is limited to returned soldiers.

PERSONNEL:

J. E. Jackson, D.L.S., in charge.

Assistants—

D. E. Chartrand, D.L.S.  
W. A. Fletcher, D.L.S.  
D. R. Patterson.

Leveller—

D. Gurley.

Party—

Nineteen employees.

The party was organized at Prince Albert and work was begun on June 5 in tp. 44-7-2. Owing to the Winnipeg strike the levelling outfit and some other instruments did not reach the party till July 1, and no levelling was done until after that date.

On June 12 the party moved to Copeau river, in tp. 43-7-2, and commenced cutting trail. Eleven miles were cut nearly all of which was through heavy timber. Subdivision was begun on June 25 in tp. 43-7-2. The weather was favourable for surveying until September 10 when it turned wet and continued so till the freeze-up. This rain filled up the marshes and put the roads in very bad shape.

Considerable time was taken up during the season in locating and cutting out trails. This work required considerable care where marshes were numerous as poplar ridges are not continuous in such areas, and these ridges are the best locations for roads. With some grading, brushing, and draining these trails will furnish a fair means of communication within the townships and to the railroad. As these trails were intended for the future use of settlers more time was spent on cutting and grading than if they were to be used only for survey work.

Subdivision was completed on December 13, and two days later the party was disbanded at Prairie River.



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*Party No. 3—Surveys in Porcupine Forest Reserve*

On May 29 the party moved from Winnipeg, the point of organization, to Prairie River, in tp. 49-7-2. From there a road had to be

## PERSONNEL:

A. L. Cumming, D.L.S., in charge.

## Assistants—

J. H. Patterson, D.L.S.  
Jas. Gibbon, D.L.S.

## Leveller—

D. S. Glen.

## Party—

Eleven employees.

made to the work in tp. 41-10-2, a distance of forty-two miles. The cutting, grading, corduroying, and bridging of this road was completed on July 5 and at present it is the only means of access to the Porcupine Reserve settlement from Prairie River. The provincial government have since improved the first ten miles of this road by putting in culverts, and bridging Red Deer river with a steel bridge and Copeau river with a wooden bridge.

Survey work was begun on July 7 in tp. 41-9-2, and continued through the townships to the west and south. Fresh-water lakes are numerous, fifty-four being found in the north half of tp. 42-10-2.

The district appears to be well adapted for farming as the soil is good and on a number of homesteads areas of five to twenty acres could be put in without any clearing. Moose and deer are plentiful, as are also feathered game consisting of ducks, partridges, and prairie-chickens.

The traversing of the water areas was not done at the time of subdivision as it could be executed much more economically on the ice. This traversing was completed on January 9, 1920, and the party disbanded on the 15th.

*Party No. 4—Surveys near Prairie River, Saskatchewan*

Some of the townships withdrawn from the Porcupine forest reserve for the purposes of soldier settlement were subdivided by this party.

## PERSONNEL:

E. P. Bowman, D.L.S., in charge.

## Assistants—

F. W. Beatty, D.L.S.  
C. A. R. Lawrence.

## Leveller—

W. H. Dowling.

## Party—

Nine employees.

On June 2 the cutting of a twelve-mile wagon road through heavy timber was commenced. This road was made to enable prospective settlers to reach the locality. Additional branch roads had to be cut to reach the different townships subdivided.

Work on the roads was completed on June 27, although other work was necessary later to complete them, and by the end of June settlers were coming in. This settlement in advance of the survey was possible owing to the fact that the old subdivision monuments could be used in locating lands and that there was no material difference between the old and new surveys. A modification of the subdivision was made whereby east and west road allowances were located one and a half miles apart instead of two miles in order to give each soldier settler a grant of 240 acres.

Survey operations were closed on December 13, and the party disbanded.

*Party No. 5—Surveys Southwest of Calgary, Alberta*

The work allotted to this party consisted of a number of miscellaneous subdivisions in connection with mineral claims, leases for coal mining, and leases for grazing.

## PERSONNEL:

N. C. Stewart, D.L.S., in charge.

## Assistant—

A. M. Perry, D.L.S.

## Party—

Eight employees.

Work was begun in tp. 40-13-5 on May 20, but owing to the density of the smoke from neighbouring forest fires no observation could be taken until the 23rd. A snowfall of three inches on May 30 and 31 completely extinguished the fires.



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The most valuable asset of this district is its coal areas, some mines having a daily output of about 100 tons. The surface is fairly well timbered, but when the timber is cut off the land will furnish good grazing.

On September 26 nearly two feet of snow fell and the weather turned cold. This hindered survey work as some of the work was at an elevation of 8,000 feet and climbing snow-covered slopes made progress difficult. Although some of this snow melted away more came later, and survey operations were finally closed on December 20.

*Party No. 6—Surveys West of Dunvegan, Alberta*

This work was reached from Spirit River on the Edmonton-Dunvegan and British Columbia railway. Wagons were used for

PERSONNEL:

R. H. Knight, D.L.S., in charge.

the first six miles but pack-horses had to be used for the remaining distance to tp. 79-7-6, where work was begun on May 27.

Assistants—

J. E. Morrier, D.L.S.

A. Fawcett, D.L.S.

A number of squatters, chiefly returned soldiers, were located in the adjoining townships and subdivision was extended to enable them to make improvements when the boundaries of their homesteads were known.

Leveller—

A. H. Melville.

Party—

Nine employees.

The subdivision in this locality was completed on August 20 and the party moved to tp. 81-15-6, in the Pouce Coupé district.

Progress here was greatly retarded by Kiskatinaw river, as the valley is 600 to 700 feet deep with steep hillsides and almost impassable cut-banks. The river drops about forty feet in a mile, which produces considerable current. Heavy rains produced a swollen stream, which added considerably to the difficulty of crossing the river.

A heavy frost was experienced on October 8, followed by four inches of snow. This was followed by further snowfalls so that progress was difficult. Work was accordingly stopped on October 27.

*Party No. 7—Surveys North of Peace River, Alberta*

The party was organized at Edmonton on June 9, and proceeded by rail to Peace River, thence by steamer to Brown's landing,

PERSONNEL:

F. V. Seibert, D.L.S., in charge.

thence by wagons to tp. 90-23-5, and thence by man-packing and pack-horses to the work in tp. 89-23-5, which was reached on June 19. An over-land trail which is fairly good to tp. 88-23-5 runs from the town of Peace River, but two muskegs beyond the base line, each about half a mile wide, are impassable in summer except for pack-horses and very lightly loaded wagons.

Assistant—

E. C. Coursier, D.L.S.

Leveller—

J. N. Macdonald.

Party—

Eleven employees.

All the control lines were cut with good clear sky-lines, and observations were taken with a six-inch block survey transit to check the bearings of these control lines.

The usual method of chainage was followed, and tests for chain correction were frequently made with the subsidiary standard measure. The average closing of section blocks was less than a link.

Levels were run on all the lines, and where errors were suspected in lines outside the work the lines were re-levelled and the error corrected. The level closings for section blocks of four miles circuit averaged 0.07 feet.

Care was taken to place the posts accurately on line and have the top flush with the ground. Impressions were taken of the markings on the tops of the posts, which make a reliable check on the markings on the posts as they are on the ground.



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Besides the regular topography taken by the chainers in the ordinary course of their work, an effort was made to secure the general topography of the interior of the sections.

The season was very wet from June to October, scarcely a day passing without rain. On October 7 there was a fall of about eight inches of snow. This, however, was unusual as snow seldom falls in any quantity before Christmas.

*Party No. 8—Surveys near Fort Vermilion, Alberta*

The townships subdivided by this party lie along Peace river, about thirty miles west of Fort Vermilion.

## PERSONNEL:

J. A. S. King, D.L.S., in charge.

## Assistant—

C. B. C. Donnelly, D.L.S.

## Leveller—

E. Nelson.

## Party—

Nine employees.

Work was begun in tp. 105-16-5 on May 19.

The season was very wet, the downpour of rain flooding the country on every side. Many of the lines were run through timber standing in twelve to eighteen inches of running water, and one creek rose from six feet deep and eight feet wide to fifteen feet deep and one hundred and fifty feet wide. These conditions greatly retarded the work.

Side-hills, cut-banks, and heavily timbered coulees also hindered progress.

Operations in this district were closed on September 30 in order to catch the last boat up Peace river.

The next work was the subdivision of part of tp. 66-2-5, the survey of which was requested by the soldier students of the agricultural section of Alberta University. This work was begun on October 17 and the party was disbanded on November 15, the work being completed.

This party also surveyed three timber berths on Muskwa river, near Fort Alexander, Man. This work was begun on February 19, and finished on March 14.

Progress was slow on account of the depth of snow, which was from two and a half to four feet and very soft. It was not necessary to cut trails as the river was used for travel and the work was completed before break-up.

## RAILWAY BELT SURVEYS

Surveys in the railway belt of the province of British Columbia were continued during this season and were confined to those areas where there was a demand for the land for settlement purposes.

In the districts of Revelstoke and New Westminster the land suitable for agricultural purposes is very valuable, hence the department has adopted the policy of subdividing the sections into legal subdivisions or forty-acre parcels, in order to meet the requirements of the small settler. This policy requires the boundaries of the legal subdivisions to be defined in addition to the quarter-section and section corners.

Two survey parties were detailed to perform all necessary work, which consisted of subdivision, stadia traverses, resurveys, and the survey of a portion of the limit of the belt.

*Party No. 1—Surveys near Revelstoke, British Columbia*

In addition to the subdivision carried out in a number of townships this party

## PERSONNEL:

W. J. Johnston, D.L.S., in charge.

## Assistant—

G. C. Tassie, D.L.S.

## Party—

Seven employees.

made traverses, took magnetic observations, and marked out the railway belt limit for seven miles in tp. 27-2-6.

The party was organized at Revelstoke and surveys were begun in tp. 19-8-6 on May 14. Transportation was hindered somewhat by bush fires which burnt the trestles of the Columbia river logging railroad. These fires also compelled the

party to cease work in tp. 27-22-5 on June 26.



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The survey of the north limit of the railway belt was then begun. This line runs along steep mountainsides and is heavily timbered with hemlock, spruce, fir, and cedar, up to three feet in diameter. Progress was slow on account of the heavy cutting and also because bush fires necessitated the recutting and rebuilding of the trails in many places. A good sky-line was cut out on the belt limit boundary and the line double chained.

The next work was the subdivision of bottom lands along Frog creek, in tp. 22-4-6, commenced on August 7 and finished on August 30. The party then returned to complete the work in tp. 27-22-5, which had been discontinued earlier in the season on account of forest fires.

Subdivision was then made in tp. 28-22-5, tp. 29-23-5, and tp. 24-19-5. The party was compelled to cease operations on October 25 owing to the fall of a foot of snow.

### *Party No. 2—Surveys near Kamloops, British Columbia*

The work done by this party consisted of traverses, resurvey, subdivision, and retracement over a very scattered area east of Kamloops.

#### PERSONNEL:

John Vicars, D.L.S., in charge.

#### Assistant—

T. J. Fullerton, D.L.S.

#### Party—

Seven employees.

Some of the land surveyed is very rough and covered with a heavy growth of timber, but a considerable portion of it is good bench land fit for cultivation. Grazing areas are numerous and many cattle were seen in good condition.

Owing to the rough nature of the country, camp had to be made at some distance from the line as neither wagons nor pack-trains could be used near the work.

The weather was very hot and dry till October when it turned cold. Operations were closed on November 28.

### MISCELLANEOUS RESURVEYS

Many applications were received from settlers for the re-establishment of the monuments defining the boundaries of their homesteads. The chief complaint as usual was that the original monuments had disappeared and as a consequence it was impossible to build fences or effect permanent improvements.

As the surveys required affected lands which were widely scattered they were made by small parties, usually a surveyor and a helper. When additional labour was required it was obtained locally. The six surveyors employed on this work travelled by automobile and were thus able to carry on their surveys with a minimum amount of lost time and to dispose of many more applications than would have been possible with other means of transportation.

### *Travelling Parties*

Six travelling parties were employed to do small, scattered, miscellaneous surveys where the expense of a large party was not warranted. Mr. Glover was assisted by one man.

#### PERSONNEL:

A. E. Glover, D.L.S.  
R. B. McKay, D.L.S.  
R. C. Purser, D.L.S.  
E. S. Martindale, D.L.S.  
W. A. Scott, D.L.S.  
P. E. Palmer, D.L.S.

Work was begun on May 15 and operations were closed on December 23, when cold weather and snow rendered work and transport by car impossible. During this period he made retracements, resurveys, correction, and stadia surveys in different parts of southern Saskatchewan and Alberta.

Commencing work on May 2, Mr. McKay was employed with the usual travelling party on miscellaneous surveys, but from September 1, owing to the resignation of another surveyor, he was engaged on the retracement of the Second meridian and



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some adjoining correction lines. When the retracement of the meridian was begun a larger transport was necessary as well as a larger party. The retracement of the meridian was continued until November 6, when the deep snow rendered further work impossible.

Mr. Purser was assisted by one labourer. The area covered lay between Kamsack, Saskatchewan, and Red Deer and Westlock, Alberta. In this area seventeen retracements and resurveys of various kinds were made besides seven traverses, three traverses and resurveys, and one investigation.

Work was begun in the latter part of May and closed in the middle of December. In addition to the regular survey operations, observations for magnetic inclination and total force were taken throughout the season with a Dover dip circle.

The work on which Mr. Martindale was engaged consisted of miscellaneous surveys, townsite surveys, retracement, and correction surveys. Subdivision lines were also extended over the beds of dried-up lakes. Although most of the work was in Manitoba it was somewhat scattered and, as the work at any one place was small, the party consisted of the surveyor and one helper.

Mr. Scott was engaged on miscellaneous surveys in the vicinity of Medicine Hat. As the location of these surveys was fairly well confined to the one district he was required to obtain information relative to roads, buildings, and elevations for use in revising the maps of the department.

In August, having completed the surveys in the Medicine Hat district, he went to Calgary intending to continue miscellaneous surveys west of this city, but before reaching the location of the work he was taken seriously ill and died in the hospital at Calgary on August 12.

Mr. Palmer's work consisted of miscellaneous surveys in the vicinity of Qu'Appelle and Broadview, Sask. In this district also advantage was taken of the comparatively limited area in which his work lay to have the surveyor record information relative to roads, buildings, and elevations to supplement the information on the maps of the department.

## STADIA SURVEYS

Stadia surveys are so called from the particular method of survey used. They provide a very accurate and inexpensive method of determining the boundaries and extent of water areas.

There were ten parties engaged on these surveys, of which two were detailed to make stadia traverses in the mineral districts of Manitoba northwest of The Pas and in the district around Rice lake, east of lake Winnipeg, and a third was engaged in making stadia traverses of lakes northwest of Prince Albert. These three parties operated in territory where no subdivision surveys have taken place, and where an accurate map of the water areas was required.

*Party No. 1—Surveys North of Winnipeg*

Two districts were investigated for water areas by this party. One was between lake Manitoba and the Principal meridian, and the other was in the Rice lake area along Manigotagan river.

## PERSONNEL:

B. W. Waugh, D.L.S., in charge.

Assistant—

G. S. Bayly, D.L.S.

Party—

Three employees.

Work was begun in the Rice lake district on June 5. The canoes in which the party travelled from lake Winnipeg up Manigotagan river to the work were used for transportation as lakes were numerous.

The purpose of this survey was to connect with proper ties the surveyed mining claims in the district and to establish sufficient reference monuments so that future surveys of mineral claims could be tied in.



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Manigotagan river was traversed across ranges 12 to 14, east of the Principal meridian, and also the larger lakes in ranges 13 and 14. From the traverse of these lakes and rivers a comprehensive map of the district can be obtained for the guidance of prospectors and mining companies operating there.

Work in this area was discontinued on September 17 owing to the need of surveys in the second area near lake Manitoba. In the Rice lake district only the area covered by 130 surveyed claims was traversed, but further surveys in the adjoining areas can be easily tied in to the monuments erected. The extension of the present survey would have the tendency to extend the prospector's radius.

The survey of the water areas between the Principal meridian and lake Manitoba was begun on September 18. The lands in this area are being taken up on account of the soldier settlement taking place in the adjoining area to the west. The purpose of the survey was to ascertain the area of land available for cultivation on account of the drying up of lakes since the last survey and also to find out if there was any likelihood of further drying up.

The surveys in this area were completed on January 21 and the party was disbanded.

*Party No. 2—Surveys in Southwestern Manitoba*

The work done by this survey party consisted of the revision of water areas, the investigation of roads and buildings, and the taking of elevations in one hundred and nine townships in the vicinity of Virden, Hamiota, and Broadview.

PERSONNEL:

G. A. Bennett, D.L.S., in charge.

Assistant—

Chas. Harvey, D.L.S.

Party—

Three employees.

Work was begun on May 27 and continued without interruption till November 10. During this time an area of over three thousand seven hundred square miles was investigated and reported on.

The topography as shown on the old plans and maps was found to have undergone considerable changes; many lakes and marshes had dried up, and the land reclaimed had been placed under cultivation. In addition, thirty-one lakes, which had not been included in the original surveys, were traversed. Assiniboine river was found to have changed its course, owing to the constant erosion of its clay banks, and was traversed through two townships.

*Party No. 3—Surveys around Moosomin, Saskatchewan*

in addition to the stadia survey of water areas, information was secured for bringing up to date the sectional maps covering this district. At the request of the Soldier Settlement Board this party also subdivided a portion of Indian reserve No. 71 comprising some sections in townships 17, ranges 3 and 4, and part of Indian reserve No. 75 in township 20, range 18, west of the Second meridian.

PERSONNEL:

C. Rinfret, D.L.S., in charge.

Assistant—

S. Hunt.

Party—

Three employees.

During the summer forty-three townships were investigated for water areas, and investigation for the revision of sectional maps was carried on in forty-nine townships. Subdivision work for the Soldier Settlement Board comprised the survey of fifty-eight sections. While on this work, owing to the thick growth of bush encountered, the party was increased by two axemen. The subdivision was completed on November 11, and the party disbanded.

The surveyor and his assistant then undertook the investigation of six townships in the Moose Mountain district for the revision of sectional maps. This work was finished on November 22 and survey operations were closed.



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*Party No. 4—Surveys Northeast of Yorkton, Saskatchewan*

Besides the block of forty-five townships northeast of Yorkton, this party made a stadia traverse of all the water areas in three townships east of Kamsack.

## PERSONNEL:

P. M. H. LeBlanc, D.L.S., in charge.

## Assistant—

G. C. Britton, D.L.S.

## Party—

Three employees.

Survey operations were begun on May 24 and were continued until November 4 when work in the field was stopped owing to the early freeze-up.

In addition to the traverse of lakes, the conditions of all monuments were investigated, and all the roads were classified according to the quantity and class of traffic over them.

A heavy rainfall between June 27 and July 14 made very bad roads and the lakes and marshes were flooded. This made traverse work and transport difficult.

*Party No. 5—Surveys in Northern Manitoba*

The stadia traverses made by this party were somewhat different from those made by the ordinary stadia survey parties. They were located for the most part in unsurveyed territory and were not made for the purpose of correcting existing township plans, but to definitely locate the rich ore deposits lying between the 17th and 18th base lines, extending westerly from range 16, west of the Principal meridian, to range 3, west of the Second meridian.

## PERSONNEL:

T. H. Plunkett, D.L.S., in charge.

## Assistants—

C. J. Harper, D.L.S.

W. A. Spence, D.L.S.

## Party—

Twelve employees.

Most of the mineral claims have been staked on the shores of the lakes and rivers which form a continuous waterway from Wekusko lake at the easterly end to Amisk lake at the westerly end. The reason the country remote from the main waterway has not been examined is not because of lack of indications of minerals, but because there is no available map for the prospector's guidance and also because the surface has a covering of moss from one to three feet deep which prevents the prospector from making an examination of the rock formations.

Before a map of the district can be made, sufficient township outlines will have to be run between the two base lines to tie in the survey of the numerous lakes.

The stadia traverse of the lakes was discontinued on September 19 and the party moved to Sturgeon Landing where work was begun on a portion of the boundary between Manitoba and Saskatchewan. In addition to this boundary survey, part of the 18th base line was run across range 30, west of the Principal meridian.

On October 8 winter set in with a heavy fall of snow, and on the 12th Saskatchewan river froze over. Operations were accordingly closed on October 17.

*Party No. 6—Surveys near Prince Albert, Saskatchewan*

While most of the work done by this party lay in the district around Prince Albert, a considerable portion lay in Manitoba near Winnipeg and Dauphin.

## PERSONNEL:

P. J. McGarry, D.L.S., in charge.

## Assistant—

B. Hagarty.

## Party—

Six employees.

The investigation of the water areas in eight townships around Prince Albert was first undertaken as the work in Manitoba was in a marshy district and could be executed to better advantage in late summer or fall. Work was accordingly commenced on June 2 east of Prince Albert, and

the party then moved to Batoche to resurvey a base line across lots in St. Laurent settlement.



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Investigation was next made of five townships near Shellbrook, and on September 16th the party moved to Langham to investigate seven townships in that vicinity. All the work was completed there except the traverse of North Saskatchewan river, which had to be discontinued on account of floating ice.

The next work undertaken was some special investigation of water areas near Dauphin, Man. This work was completed on November 15 and the party was disbanded.

In addition to the regular stadia surveys roads were classified and magnetic observations taken.

*Party No. 7—Surveys in Northwestern Saskatchewan*

This party was engaged on the stadia traverse of the chain of lakes and rivers lying on the northern side of the height of land separating Churchill and Saskatchewan rivers and forming the drainage basin of the upper Churchill.

PERSONNEL:

G. H. Blanchet, D.L.S., in charge.

Assistants—

M. G. Cameron, D.L.S.

R. D. Davidson, D.L.S.

Party—

Seven employees.

As subdivision surveys have not yet been extended to this district the information furnished by existing maps is based on exploratory and base line surveys and it was for the purpose of obtaining accurate maps of the waterways of the district

that these stadia surveys were made.

Stadia work was begun on May 14 and continued until October 8, during which time more than 1,000 miles of shore line were defined.

The following lakes and rivers were traversed: Cowan lake, Delaronde lake, Smoothstone lake, Sled lake and river, Green lake, Canoe lake, Doré lake, lac la Plonge, rivière la Plonge, Beaver river, lac Ile-à-la-Crosse, Shagwenan lake, and Montreal lake.

Simultaneously with the stadia traverse an investigation survey was made of the wagon roads from Big River to lac la Plonge, and from Prince Albert to Montreal lake. A survey was also made of Ile-à-la-Crosse settlement.

On October 9 the party was reduced to one assistant and three men to conduct an exploration survey of a road from Big river to the Grand rapids on Beaver river. This was completed on October 22 and the party returned to Prince Albert and was paid off.

*Party No. 8—Surveys South of Medicine Hat, Alberta*

The area along the Canadian Pacific railway south of Medicine Hat was investigated and all bodies of water, as well as rivers over one chain in width, were traversed. Monuments were erected where the lake beds had dried up, and the condition of the roads in fifty-four townships examined.

PERSONNEL:

G. C. Cowper, D.L.S., in charge.

Assistant—

J. Carroll, D.L.S.

Party—

Three employees.

Work was begun on May 31 in tps. 9 and 10-1-4. Lakes and sloughs were not very numerous and

consequently more time could be devoted to mapping roads for the revision of the sectional maps.

Over 3,000 barometric readings were taken which will greatly assist in showing contours on the sectional sheets.

Winter set in early and survey operations were closed on October 27.



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*Party No. 9—Surveys South of Stettler, Alberta*

A reconnaissance survey of lands northeast of Prince Albert was made by this

## PERSONNEL:

W. H. Norrish, D.L.S., in charge.

## Assistant—

J. S. McIntosh, D.L.S.

## Party—

Three employees.

party before commencing the regular stadia work. This reconnaissance work was undertaken at the request of the Soldier Settlement Board with a view to ascertaining the nature and extent of such lands within these districts. It was merely a preliminary investigation and any tracts found suitable for soldier settlement were to be fully

investigated.

Work was commenced on May 17 and the area along Whitefox river westerly from tp. 51-15-2 to range 23, comprising approximately 250 square miles, was examined.

This work was completed on May 31 and a similar examination was made of the area around Paddockwood in tp. 52-25-2. The district is about twenty-five miles from Prince Albert and a great deal of worthless land lies between, but around Paddockwood the land is good though heavily wooded.

This work was completed on June 13 and the party left for Hanna to begin the regular stadia surveys. An automobile was used for transportation, as the district is fairly dry and the lakes few and scattered. This work was carried on for a month during which water areas in twenty townships were investigated. In addition the roads were classified and barometer readings taken frequently.

From July 26 this party was again employed on reconnaissance work in the Whitecourt district northeast of Edmonton, comprising about twenty-nine townships, ten of which are within the Lesser Slave Lake forest reserve.

This work was finished on August 27 and from that date until October 4 a reconnaissance survey was made of the district around St. Paul de Metis. Transportation was carried on by man-packing or, where trails were passable, with pack-horses or automobile.

When the reconnaissance work was finished this party made a traverse of the delta of Red river at the south end of lake Winnipeg. The traverse was completed on December 17.

*Party No. 10—Surveys Northeast of Edmonton*

The water areas investigated by this party lay in about forty townships along the

## PERSONNEL:

H. M. R. Soars, D.L.S., in charge.

## Assistant—

C. B. Atkins, D.L.S.

## Party—

Three employees.

north side of North Saskatchewan river from the Alberta and Great Waterways railway east as far as range 9.

Work was commenced on June 6 in tp. 59-21-4 and consisted of the traverse of water areas of sufficient size, reporting on others that have partially or completely dried up, examining monuments, classifying roads and making some retracements of

school lands.

In addition to the lake and slough surveys North Saskatchewan river was traversed through ranges 10 to 14 and when this work was completed the party was disbanded on December 15.

Early in February, 1920, the party was again organized and a traverse of Sturgeon river made through the district covered by the Edmonton sectional sheet. The presence of water on the ice under the snow rendered this work unsafe and it was postponed till March when the river was traversed to the east boundary of section 8, tp. 55-24-4.

Survey operations were closed on March 7.



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## RETRACEMENT OF SCHOOL LANDS

The retracement of the boundaries of school lands, sections 11 and 29 of each township, was continued this year.

In well-settled areas these lands are being sold by auction and high prices are obtained. Considerable difficulty was met with because of the disappearance of many of the monuments of the original survey. The purchasers expect that their boundaries will be clearly and permanently marked and further wish to know the exact acreage of the lands they have to pay for.

Accordingly six survey parties were detailed to survey the school lands in the districts in which it was proposed to hold sales, surveying them in the order in which they were to be sold. As the work was rather scattered each party was limited to one man supplemented by local labour where necessary.

As there was considerable travelling and no great amount of work at any one place transportation was carried on by means of automobiles.

*Party No. 1—Surveys in Portage la Prairie District*

The work performed by this party consisted chiefly of the retracement of the boundaries of school lands in a block of thirty townships, comprising townships 7 to 11, ranges 6 to 11, west of the Principal meridian, and situated within a radius of forty miles south of the city of Portage la Prairie.

PERSONNEL:

C. H. Taggart, D.L.S., in charge.

Party—  
One employee.

These lands are exceedingly valuable and it is very important that the boundaries of the sections be correctly defined and the areas of the quarter-sections accurately determined. Numerous resurveys and retracements and the re-establishment of many lost corners were necessary owing to the disappearance of many of the old monuments. The surveys in this block were commenced on June 11 and completed on October 28. Miscellaneous surveys in townships 14 to 17, ranges 1 and 3, and township 15A, range 11A, all east of the Principal meridian, occupied the time of the party until December 12, when it moved to township 21, range 31, west of the Principal meridian to perform resurveys. This work was completed on December 24 and field operations for the season were closed.

*Party No. 2—Surveys in Brandon District*

The retracement of school lands in a block of eighteen townships situated within a radius of twenty miles to the north and east of the city of Brandon constituted the work of this party during the season. Surveys were commenced in the field on May 27 in the vicinity of Minnedosa and continued in a southerly and easterly direction until October 31, when operations in the field were closed.

PERSONNEL:

H. E. Pearson, D.L.S., in charge.

Party—  
One employee.

This is a very old district and many of the original monuments have been lost or obliterated which necessitated retracement of old boundaries, resurveys, and re-establishment of lost corners where the school lands adjoined patented lands. The owners of these patented lands had to be consulted before erecting new monuments, which procedure took much time as in many cases the lands were rented and the owners were living some distance away.



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*Party No. 3—Surveys in Regina District*

The work of this party was begun on May 16 practically where it was left off the previous fall.

## PERSONNEL:

L. E. Fontaine, D.L.S., in charge.

Party—

One employee.

It consisted of retracement and the re-establishment of lost corners in connection with correctly defining the boundaries of school lands in a block of twenty-four townships comprising townships 13

to 19, ranges 16 to 22, west of the Second meridian.

School land investigation was discontinued on October 25, when the unusually early snowfall made the location of obliterated corners impossible. From this date until November 21, when operations were closed, the party was employed on minor miscellaneous surveys and also recording magnetic observations.

*Party No. 4—Surveys in Swift Current District*

This party was engaged on the investigation and retracement of the boundaries

## PERSONNEL:

J. M. Coté, D.L.S., in charge.

Party—

One employee.

of the school lands lying in a block of fifty-five townships situated within a radius of forty miles east of Swift Current and comprising townships 12 to 18, ranges 7 to 14, west of the Third meridian.

Work was commenced in the field on May 25 and was continued until October 31, when owing to the early snowfall and arrival of winter the party returned to Swift Current and was disbanded.

*Party No. 5—Surveys in Calgary District*

The school land sections in townships 29 to 32, ranges 23 to 28 west of the Fourth meridian, were retraced by this party.

## PERSONNEL:

C. M. Walker, D.L.S., in charge.

Party—

One employee.

Work was begun on May 24 in the district directly east of Didsbury. All original monuments were replaced by standard monuments, but no permanent marks were made where the original

monument was lost if the interested landowners refused to consent to the resurvey. In some portions of the district considerable time was spent collecting evidence as to the position of the original corner monuments where the monuments were badly obliterated.

The retracement of school lands was stopped on September 16 and the party was employed on lot surveys at Banff and afterwards on traverse of Ghost river, northwest of Calgary, and Sheep creek, southeast of Calgary.

On account of a heavy snowfall work had to be suspended from November 6 to 19 but extremely cold weather set in later and work was finally stopped on December 3.

*Party No. 6—Surveys in Wetaskiwin District*

The investigation and retracement of school lands in the block of twenty-two townships comprising townships 44 to 47, ranges 23 to 28, west of the Fourth meridian,

## PERSONNEL:

J. A. Buchanan, D.L.S., in charge.

Party—

One employee.

constituted the work of this party. The lands in this block are of great value as no quarter-section investigated lies at a greater distance than

twenty miles from the important town of Wetaskiwin and those quarter-sections in township 46, range 24, west of the Fourth meridian, are within two or three miles of the town.



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Operations in the field were commenced on May 28 and the investigation of school lands was carried on till September 22. On this date the number of employees on the party was increased to seven and the survey of mining leases in township 50, range 27, west of the Fifth meridian, was undertaken. Work in this township was completed on November 27 when the party returned to Edmonton and was paid off.

## LAND CLASSIFICATION

In order to find suitable lands for returned soldiers, as well as all other intending settlers, and to ensure that lands not offering a fair chance for successful settlement be excluded, four parties were engaged on investigation and classification of Dominion lands. The examinations were so planned as to meet the requirements of the returned soldiers first, and, as the restrictions on settlement were gradually removed, to make the information obtained available for all settlers. From the information furnished by these surveys, reports and maps were prepared showing not only the various classes of agricultural lands but also the resources of the districts. The maps showed the principal topographical features, roads and trails, existing settlements, elevations, etc., so coloured and arranged as to make each feature stand out by itself.

The lands examined were divided into eight classes as follows:—

- (a) Lands disposed of.
- (b) Lands suitable for immediate settlement.
- (c) Lands considered fair for settlement.
- (d) Lands which can be economically improved.
- (e) Lands with suitable soil but requiring extensive improvements.
- (f) Hay meadows.
- (g) Grazing lands.
- (h) Worthless lands.

The information collected was made available to the public through the Dominion land offices and the Soldier Settlement Board.

*Party No. 1—Surveys North and East of Dauphin, Manitoba*

The district examined by this party comprises all that area of land lying to the east of the Canadian National railway between Ochre River on the south and Birch River on the north and bounded on the east by the shores of lake Winnipegosis.

## PERSONNEL:

S. D. Fawcett, D.L.S., in charge.

## Assistants—

P. A. Shaver, D.L.S.

D. O. Wing, D.L.S.

M. D. McCloskey, D.L.S.

## Party—

Four employees.

the party disbanded.

During this period a total of 13,104 quarter-sections, containing 2,096,640 acres, were examined and classified. In addition, throughout the area, frequent samples for soil analysis and barometric readings were taken.

*Party No. 2—Surveys in Pasquia and Porcupine Forest Reserves*

The district examined by this party included all the land lying in townships 40 to 46, ranges 1 to 12, west of the Second meridian, the greater portion of this area being included in the Porcupine and Pasquia forest reserves.

## PERSONNEL:

Wm. Christie, D.L.S., in charge.

## Assistants—

C. S. Macdonald, D.L.S.

A. O. Gorman, D.L.S.

N. S. Clouston, D.L.S.

## Party—

Six employees.

Work was commenced in the field on May 20 in tp. 45-3-2 and carried on in a southerly and



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westerly direction until November 26, when field operations were closed for the season.

During the season 6,828 quarter-sections, containing a total of 1,092,480 acres, were examined and reported on. In addition to this a reconnaissance survey was made of 1,440 quarter-sections, comprising 130,400 acres, in townships 46 to 50, ranges 3 to 12, west of the Second meridian.. During the season's work frequent samples for soil analysis and barometer readings were taken.

*Party No. 3—Surveys North of Edmonton and Northwest of Turtleford*

Examination of lands in the district north of Edmonton, between Athabaska river and lac la Biche, was begun by this party on May 12 and continued until June 25.

## PERSONNEL:

D. F. McEwen, D.L.S., in charge.

## Assistants—

S. H. Gordon, D.L.S.  
W. E. Lumb, D.L.S.  
W. E. Robinson, D.L.S.  
R. P. Burchnall, D.L.S.

## Party—

Four employees.

On this date the three assistants attached to the party were paid off and the surveyor with one assistant and the same party began reconnaissance surveys in the district northwest of Turtleford, Saskatchewan, from Meadow lake westerly to the Fourth meridian. Field operations were completed and the party disbanded on December 10.

During the season 12,240 quarter-sections, comprising an area of 1,958,400 acres, were examined. Numerous samples for soil analysis and frequent barometer readings were taken.

*Party No. 4—Surveys in the Peace River District*

The area examined by this party may be roughly described as all that portion of the Peace River district lying between latitudes 55 degrees and 57 degrees and extending from Lesser Slave lake westerly to the boundary between Alberta and British Columbia.

## PERSONNEL:

L. Brenot, D.L.S., in charge.

## Assistants—

E. F. Gorman, D.L.S.  
K. F. McCusker, D.L.S.  
A. H. King, D.L.S.

## Party—

Four employees.

Work was commenced on May 16 in townships 86 and 87, ranges 23 to 25, west of the Fifth meridian, and was continued westerly to the foot of the Clear hills and then southerly to the district lying

around Grande Prairie, where operations in the field were closed on November 19.

During the season 12,540 quarter-sections, comprising 2,006,400 acres, were examined and classified. In addition frequent barometer readings and samples for soil analysis were taken in the area covered.

## TOPOGRAPHICAL SURVEYS

Five parties were employed, four of them being engaged on the revision of sectional maps and one on the survey of the Bow River and Clearwater forest reserves.

The revision of sectional maps is executed by small parties travelling rapidly over the country and securing by expeditious methods the information necessary to transform the land maps into topographical maps.

*Party No. 1—Revision of the Winnipeg Sectional Map, No. 73*

Winnipeg sectional map comprises townships 1 to 16, ranges 1 to 11 east, and ranges 1 to 4, west of the Principal meridian. All

## PERSONNEL:

G. H. Herriot, D.L.S., in charge.

## Assistant—

J. F. Fredette, D.L.S.

the information available regarding roads, elevations, and topography was obtained from the Land Titles office, The Good Roads Branch of the provincial government, and the Department of Public



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Leveller—  
George Ross.

Works at Winnipeg. This information was supplemented by that obtained by the field examination.

Party—  
Three employees.

As the character of the country covered by this map varies considerably in the different localities a severe strain was at times placed on the transport. Many streams had to be traversed which were exceedingly crooked and in places bordered with bush. Streams of this nature require considerably more time and present far greater difficulties than those in districts farther west.

Considerable difficulty was also experienced in carrying on the work in those portions of the district taken up by parishes and settlements which were surveyed into river lots before the inauguration of the Dominion Lands system of survey. In many cases several of these lots were owned by one man and joined together to make one farm. As the boundaries have practically disappeared some difficulty was experienced in getting definite points to which to tie in the topography.

The easterly portion of the district is undulating with many large areas of swamp and mostly covered with bush with practically no roads and few trails. The work here had to be executed on foot. The westerly portion was chiefly open with well-defined land boundaries enabling the surveyor to obtain most of the required information from his seat in the car or democrat.

Work in the field was completed on October 29, when the party disbanded.

*Party No. 2—Revision of the Saskatoon Sectional Map, No. 218*

Townships 33 to 40, ranges 1 to 14, west of the Third meridian, are covered by this sectional map. About a month was spent by the party in organizing and in securing all possible information about roads, bench-marks, etc., before it took the field on June 11. Speedometers on the motor-cars used for transport gave the distance from known points to streams, houses, etc.

PERSONNEL:

W. J. Boulton, D.L.S., in charge.

Assistant—

J. Hardouin, D.L.S.  
S. C. Akins.

Party—

Two employees.

Aneroid readings were taken at every mile in level country and at every half mile in rolling country and in addition at numerous points showing change of slope. In all over 13,000 readings were recorded.

In addition to the revision work, this party subdivided some sections in tp. 40-14-3 that were withdrawn from the Keppel forest reserve, and also ran four miles of line to restore lost monuments.

On November 19 all survey work was completed and the party was disbanded.

*Party No. 3—Revision of the Blackfoot Sectional Map, No. 115*

The area investigated by this party comprises townships 17 to 24, ranges 16 to 29, west of the Fourth meridian. Between three and four weeks were spent by the surveyor and one assistant at Calgary in collecting information, mainly about elevations, at the Levelling office, the Land Titles office, the office of the Commissioner of Irrigation, and the Canadian Pacific Railway Irrigation office. The party took the field on June 6.

PERSONNEL:

J. R. Akins, D.L.S., in charge.

Assistants—

C. P. Hotchkiss, D.L.S.  
E. R. Moorhouse.

Leveller—

A. I. Ponton.

Party—

Two employees.

A large part of this district is included in the Canadian Pacific Railway irrigation scheme and has been accurately surveyed. Plans of these surveys showing contours were obtained and were of great assistance in the prosecution of the work.



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The country covered by this sheet was open and rolling enabling the party to carry on the work rapidly. The larger rivers and streams had been traversed in the original surveys and the surveyor had only to deal with the small streams.

Work was completed on October 16 when the party disbanded.

*Party No. 4—Revision of the Edmonton Sectional Map, No. 315*

Edmonton sectional map comprises townships 49 to 56, ranges 15 to 28, west of the fourth meridian. About two weeks were spent

## PERSONNEL:

J. W. Pierce, D.L.S., in charge.

## Assistants—

W. P. Daly, D.L.S.

E. S. Fry.

## Party—

Three employees.

by the surveyor and his assistants in organizing and outfitting and in collecting information at Edmonton from the Surveys, Highways, and Drainage Branches of the provincial government, and from the Levelling Office at Calgary. The party took the field on June 2.

The district is fairly well timbered and lakes and streams are numerous, all of which tended to delay the work. A number of lakes were noted which were not shown on the township plans and the courses and connections of some streams were found to have been plotted in error.

The season's work was completed on October 31 and the party was disbanded.

*Party No. 5—Photo-Topographical Surveys in Bow River and Clearwater Forest Reserves*

This party commenced work in the field on June 15 from a point on the Red Deer traverse, where the work was discontinued

## PERSONNEL:

M. P. Bridgland, D.L.S., in charge.

## Assistant—

L. E. Harris, D.L.S.

## Party—

Six employees.

in 1918. This traverse was then extended up Scalp creek, a tributary of Red Deer river, to a point on Clearwater river near the summit of Pipestone pass. From here the traverse was carried down Clearwater river to a closing on the Dominion lands survey system. The total distance covered by this traverse amounted to about

sixty-nine miles. Permanent monuments were erected at intervals, approximately two miles apart, along the entire traverse.

A photographic survey was carried on at the same time as the stadia traverse, the photographic stations being established by triangulation based on the stadia traverse.

The total number of stations occupied was eighty, of which number seven were over 10,000 feet and twenty-nine were from 9,000 to 10,000 feet above sea-level.

The survey was continued down the Red Deer valley to connect with the work done in 1918, and was carried on in the Clearwater valley to include the entire basin of the river.

On September 22 field operations for the season were closed and the last members of the party were paid off.

## LEVELLING

The amount of levelling of all classes run during the twelve months ending March 31, 1920, was 3,458 miles. There was an increase in mileage of all classes over the corresponding amounts done in the previous year except in the class of levels run along meridians and base lines during their original survey. As no new lines of that class were surveyed, no levelling was done.

One party was engaged on precise levels throughout the season and another party for a short time at the beginning of the season.



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The secondary control lines are levelled along base lines previously surveyed, but which were not levelled. These are important and most useful levels as they control the large area between base lines, and they run, as a rule, through districts where previously there was little or no local control. A permanent bench-mark consisting of a two-inch iron pipe four feet long with a large foot-plate is planted firmly every third mile with its top appearing about six inches above ground. Elevations of the ground every quarter mile and all streams and lakes encountered are recorded. Three parties were employed on such levels.

Two parties were employed all season and one party for a short time at the end of the season, in levelling the outlines of townships without doing any interior levelling. With an experienced leveller such outlines need not be checked, reliance being placed on the leveller's ability to close his circuit correctly. Outlines were thus run around some sixty-three townships. The closing error of the 24-mile circuit never exceeded three-tenths of a foot during the season.

In subdivision surveys levelling was done along the section lines while they were being surveyed and 1,232 miles were thus levelled. While only intended to serve the immediate surroundings and to afford a general record of the topography this class of levels has been so well carried out that their records may be confidently relied upon in all matters which depend on a knowledge of the relative elevations of a local district. All subdivision levels, even those in townships in the extreme north, have been connected to a sea-level datum, and all their elevations are actually so recorded with the exception of only about six townships out of a total of 8,200 miles of such levels.

The work of recording all the results in a clear and readily accessible form has been kept up to date and there is no difficulty in quickly obtaining any one of the many hundreds of thousands of elevations already recorded.

The number of miles of the various classes of levels run during the year and the total at the end of the year are as follows:—

	Season 1919	Total
Precise levels.. . . .	470	3,917
Secondary control levels.. . . .	776	2,181
Meridian and base line levels.. . . .	...	12,268
Township outline levels.. . . .	902	902
Subdivision levels.. . . .	1,232	8,199
Other lines of levels.. . . .	78	399
Totals.. . . .	3,458	27,866

Party No. 1—Precise Levels from Lacombe to Eyebrow

This line of levels was run along the Canadian Pacific railway southeasterly through the central parts of southern Alberta and Saskatchewan. The intention was to continue the line to Moose Jaw, an important junction point for precise levelling, but an unusually early advent of severe weather compelled the party to end operations at Eyebrow, 45 miles from Moose Jaw, on November 3. The distance levelled was 402 miles.

PERSONNEL:

L. O. R. Dozois, D.L.S., in charge.

Assistant—  
G. Palsen.

Party—  
Six employees.

The work was carried out strictly in accordance with precise levelling methods, each mile being required to be levelled twice within an agreement of 0.015 feet. The large mileage levelled was due in great measure to the use of a 4 horse-power, railway motor-car of light construction. This not only facilitated the actual work but enabled camps to be selected within much wider limits than if a handcar only had been used.

In addition to the accurate line carried forward as a control for the large area through which it runs and the planting of permanent bench-marks at least every fourth mile a large number of subsidiary elevations were recorded. These included



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hundred and two were established of which eighty-three were on specially constructed concrete pillars whose foundations are six feet deep and whose tops appear ten inches above the surface. The remainder were on buildings of various kinds. At the end of each mile a temporary bench-mark is also placed, generally consisting of a large railway spike driven into a telegraph pole. Its elevation is reliable to a tenth of a foot as long as the pole is not bodily removed. These marks have proved especially useful for many local purposes.

This line of precise levels crossed six of the secondary control lines of levels run in previous years, and thus affords an important connection throughout the level system.

*Party No. 2—Secondary Levels along Base Lines*

This party levelled the Seventh base line easterly from the Fifth meridian to the east outline of range 12, west of the Fourth meridian and from the Fourth meridian to the middle of range 14, west of the Second meridian.

## PERSONNEL:

J. B. Alexander, D.L.S., in charge.

## Party—

Five employees.

The transport consisted of two teams and two wagons until the end of July, when a motor-car was supplied. This latter facilitated the progress

of the work very materially but several stretches of country were met with where a motor-car could not be brought nearer to the line than four or five miles and it would have been very difficult to have dispensed with horses.

At the beginning of the season permanent bench-marks were placed at intervals averaging four miles. These were the standard iron-pipe bench-marks used by this branch. From August 1, however, the interval between successive bench-marks was reduced to three miles. The extra work entailed by increasing the number of bench-marks is scarcely appreciable, while the placing of one at the centre of the north boundary of the township and one at the northeast corner is a much more satisfactory arrangement than that formerly employed.

During the season 111 permanent bench-marks were planted and connection was made to four precise and to four secondary lines of levels which had previously been levelled. The length of main line levelled was 378 miles with an additional 39 miles of connections.

The highest elevation encountered was 3,597 feet, close to the Fifth meridian where the line of levels commenced. At Last Mountain lake, near the end of the work, the elevation was 1,607 feet, a fall of almost 2,000 feet. Three ranges of hills rising over 600 feet were encountered between the Third and Fourth meridians.

*Party No. 3—Secondary Levels along Base Lines*

Levelling was commenced on May 19 at the Fifth meridian and carried easterly along the Thirteenth base until June 30, when range 12 west of Fourth meridian, was reached.

## PERSONNEL:

R. H. Montgomery, D.L.S., in charge.

## Party—

Six employees.

On July 4 levelling was commenced on the Eleventh base at the Fourth meridian and continued easterly until the Third meridian was reached on October 2. Between October 6 and

November 5 a single line of levels was run around the outlines of townships 38, in ranges 6 to 12, west of the Third meridian.



SUMMARY OF RESULTS

Miles of control levels run.. . . . .	269
Miles of connection levels run.. . . . .	68
Miles of single-line levels run.. . . . .	141
Permanent bench-marks established.. . . . .	113

For the first time motor-cars were used on this work and they proved highly satisfactory. The standard maintained on the control levels was such that 98 per cent of the local discrepancies per mile were less than 0.03 feet. Regarding the single-line levelling around township outlines, the average closure of the 24-mile circuits was 0.08 feet.

The future value of a line of levels depends on the permanency of the bench-marks. Bench-marks are being constantly destroyed. It would seem imperative that some action be taken towards establishing some bench-marks of a very lasting character in addition to the present standard bench-mark. Such additional bench-marks could be placed 12 miles apart.

Party No. 4—Secondary Levels along Base Lines and Precise Levels from Assiniboia to Moose Jaw

The first work undertaken by this party was a line of precise levels along the Canadian Pacific railway from Assiniboia to Moose Jaw. The line was commenced on July 1 and completed on August 2. The distance is 68 miles. In addition six miles of connections were run.

PERSONNEL:

E. W. Berry, D.L.S., in charge.

Party—  
Six employees.

The work was carried on in accordance with the general instructions for precise levelling. As there was no gravel along the railway suitable for concrete, galvanized-iron pipes were used instead of the standard concrete pillar for permanent bench-marks. These were two inches in diameter, four feet in length, capped and furnished with a foot-plate. Sixteen of them were placed. In addition twelve bench-marks consisting of brass bolts set in existing masonry structures were established along the route. Connection was made to the levels on the Third meridian run in 1916. The elevations of fifty-six road crossings and of the water of two lakes and of Thunder creek were recorded as well as top of rail at all railway stations along the line.

On the completion of the above a line of control levels along the Fourth base line was begun commencing at Johnstone lake and running easterly. This work proceeded without interruption until October 22 when operations were closed for the season at the northeast corner of range 7. The datum for this line was obtained by connection with B. M. AA 19 already established on the precise line from Assiniboia to Moose Jaw.

The type of permanent bench-mark used on this line was the same as on the above precise line. Permanent bench-marks were established at intervals of three miles. In all forty-four were planted. Connection was made to bench-marks of a precise level line from Weyburn to Moose Jaw at Wilcox, and to those of a control line along the east outline of range 13, west of the Second meridian. Elevations of grades were taken at the crossings of six railways. The elevations of four railway stations were recorded, also levels of seven streams and of Johnstone lake and one other lake. The Cactus hills occupy ranges 25 to 28. They rise in places to a height of 600 feet above the surrounding country. From the foot of Cactus hills easterly the country is flat or rolling prairie. The only other prominent topographical feature crossed is the valley of Moose Mountain creek, which is 120 feet in depth.



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*Party No. 5—Levels along Township Outlines*

This party was engaged in levelling the outlines of townships without doing any interior levelling in the district immediately east of Edmonton and including the areas around Cooking lake, Beaverhills lake, and Bittern lake.

## PERSONNEL:

H. E. Read, D.L.S., in charge.

*Party—*

Six employees.

During the season levels were run around some forty-eight townships, while connections were made to all precise and secondary lines and to any important lakes accessible to the work. Permanent bench-marks were established near all township corners and midway between the same, while temporary bench-marks were placed at one mile intervals.

The levels were carried forward by single line only without direct checking. Out of a total of 575 miles of main line levelled only four of the 24-mile circuits had closing errors which exceeded 0.35 feet. The order of running the outlines was so arranged that if any error should be found in closing it would be known that the error must exist in one of two of the sides. This was accomplished by always having the other two sides closed by a previous circuit. In the forty-eight townships levelled all except four had their circuits closed and the closing errors were less than two-tenths of a foot in 77 per cent of the circuits, the remainder lying between that amount and 0.35 feet.

Field work was commenced on May 29 and was concluded on October 24. During the last three months two rodmen were used, which greatly hastened the work so that the average was 150 miles of levelling per month.

In all 575 miles of outlines were levelled by this party and one hundred and thirty-four permanent bench-marks were placed, the area throughout which the outlines were levelled being about 1600 square miles.

The season being very dry was exceptionally favourable for the work and it was possible to level many miles across dried up sloughs which in a wet season would have caused much delay.

*Party No. 6—Levels along Township Outlines*

Work was commenced on June 30 at Wadena, east of Quill lake in Saskatchewan, and was continued until October 15. A single line of levels was run along township outlines in

## PERSONNEL:

J. Russell, D.L.S., in charge.

*Party—*

Five employees.

the district northeast of Quill lake and extending around Ponass lake. The datum for the levels was obtained from the precise level line along the Canadian National railway running past Wadena.

Elevations of all topographical features were recorded every quarter of a mile. Forty-seven permanent bench-marks were planted at intervals of three miles along the outline, being placed at township corners and in the middle of each township side. During the season 195 miles of levels were run along the township outlines. The area through which these run covers about 550 square miles, involving fifteen different townships.

## SETTLEMENTS AND TOWNSITES

To meet the wishes of the Soldier Settlement Board a survey was made of the townsite of Lens, Sask. This townsite is situated on the Canadian National railway in section 8, tp. 45-7-2, and its survey was requested in the interest of those settlers who have located in the district withdrawn from Porcupine forest reserve for the purpose of soldier settlement. In laying out the townsite provision was made for its future development.



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A survey was made of the settlement of Ile-à-la-Crosse, in tp. 74-13-3. Squatters have been in occupation of small parcels of land at this point for many years and have built houses and made other improvements. Several transfers of properties have already been made and the purpose of the survey is to facilitate further transfers and to enable the department to deal with the claims of the squatters and to issue patents or leases for their lands.

Additional subdivision was also made of villa lots at Waterton lakes, in section 23, tp. 1-30-4.

#### MINERAL CLAIMS

The discovery of gold-bearing quartz in the Rice lake district, east of lake Winnipeg, several years ago has developed a mining activity that has resulted in the survey of over fifty claims during the year. The next largest group of claims surveyed was north of Beaver or Amisk lake in northern Saskatchewan near Manitoba. Other claims were surveyed in the railway belt of British Columbia and in the Yukon Territory, the total number of claims submitted from all sources being ninety-two.

#### CONTROL OF SURVEYS

*(A. M. Narraway, D.L.S., Controller of Surveys)*

The Controller of Surveys left Ottawa on May 24 to undertake supervision of field work and proceeded at once to Edmonton where he attended to miscellaneous matters in connection with organization and the work of several parties.

He then proceeded to the Porcupine forest reserve where subdivision surveys were being carried on by three parties. These parties were subdividing lands recently withdrawn from the reserve for soldier settlement. A short distance east of there, at Roscoe, a land classification party was inspected. From there Mr. Narraway proceeded to Manitoba where three other parties were visited. This was followed by a trip to Edmonton with transaction of survey business en route, and then by a second visit to the surveys in the Porcupine forest reserve in connection with the opening of part of these lands for soldier settlement.

Four regular parties were engaged on the revision of sectional sheets and for the purpose of obtaining uniformity in the information collected and settling certain points in question a conference was held between Mr. Narraway and the chiefs of these parties at Biggar on July 19, 20, and 21. This was of great benefit in co-ordinating the work of these parties and placing their operations on a sound basis.

The parties in central Alberta were next visited and several in Saskatchewan and Manitoba. The latter part of August and the first of September was spent at the head office making preparations for the winter work, etc. The remainder of the season was occupied in arranging for winter repairs and storage of cars and other equipment, and in visiting parties. In addition, data was obtained concerning areas of land suitable for clearing by controlled fires the following year.

Throughout the season Mr. Narraway was assisted in his general work by Mr. T. H. Bartley, D.L.S., Assistant Controller of Surveys, and in the operations in the Porcupine forest reserve by Mr. T. A. McElhanney, D.L.S., Assistant Controller of Surveys.

During the winter months the usual duties were attended to and in addition special reports and other information were prepared for the Soldier Settlement Board.

*(G. J. Lonergan, D.L.S., Inspector of Surveys)*

The inspector left Ottawa for Edmonton on March 31 for the purpose of conducting experiments in clearing brule and scrub lands by means of controlled fires. The



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area selected for the experiment was situated in township 76, range 21, west of the Fifth meridian, about ten miles from the town of McLennan, to which place he proceeded on April 14. Successful firing operations were completed on May 26, when the inspector returned to Edmonton and was engaged on writing reports and assisting surveyors to organize their transport.

On June 5 the inspection of survey parties was commenced and during the season thirteen parties were visited. This is a smaller number than was inspected other years and was due to the inspector devoting much attention to those surveyors who were working in bush country, so as to obtain information regarding firing operations for the next spring. This involved much travelling owing to the parties being scattered over a wide area and being located at considerable distances from the railways.

At the close of survey operations in the field the inspector visited the various places where horses were being wintered and examined all horses with a view to discarding worn-out and useless animals. On completion of this inspection he returned to Ottawa on November 15 and was engaged during the winter making reports and preparing plans of the firing operations contemplated for the following spring.

## ALBERTA AND BRITISH COLUMBIA BOUNDARY

The method employed for the continuation of the survey of the Alberta and British Columbia boundary was similar to that of last year, Mr. Cautley defining the boundary in the Pouce-Coupé district, and Mr.

## PERSONNEL:

R. W. Cautley, D.L.S., A.L.S.,  
Commissioner for Canada and  
Alberta.

A. O. Wheeler, D.L.S., B.C.L.S.,  
Commissioner for British  
Columbia.

## Assistants—

J. T. Carthew, D.L.S.  
A. J. Campbell, D.L.S.

## Parties—

Eighteen employees.

Alberta and British Columbia boundary was similar to that of last year, Mr. Cautley defining the boundary in the Pouce-Coupé district, and Mr. A. O. Wheeler locating the line in the mountain passes from the east boundary of tp. 35-24-5 to a point about a mile north of Fortress lake in tp. 40-27-5. Work by the photographic party in the passes was commenced on June 10. Transportation was carried on with pack-horses from the supply base at Lake Louise as no nearer base could be secured. Travel was by means of saddle-horses,

which were also used to cross the hundreds of river channels, many of which would otherwise mean swimming for the men.

The survey of the boundary in the Peace River district was continued on account of the rapid settlement taking place there. The line was extended southerly through township 74 and then northerly from township 77 to township 84. Work was begun in township 74 on June 20 and finished on July 5. The northerly part was commenced on July 9 and continued until October 4.

About forty-eight miles of the boundary were surveyed exclusive of connections with former surveys and fifty concrete monuments were built. Direct and check levels were taken on all the line except where it would hinder the progress of survey in the rough country near the rivers. Where the boundary crosses Peace river it would have been necessary to cut out a special line for some miles through heavy bush to permit of levels being taken. The elevation was therefore carried across the river by trigonometric levelling and tied into the bench-marks on the twenty-first and twenty-second base lines.

## PART II—OFFICE WORK

## SUPERVISION OF FIELD WORK AND ACCOUNTS DIVISION

The work of this division showed a decided increase over that of the year 1918-19. In the month of January, 1919, the estimates were prepared and as they provided for more extensive field activities the office work increased accordingly. The most notice-



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able increase was in the number of requests for surveys, which jumped from one hundred and twenty in 1918 to two hundred and fifty-seven in 1919. These requests were all investigated as well as two hundred and twenty-six others which it was not found possible to make in previous years; the findings in each case were tabulated and filed for record. Two hundred and fifty-six instructions for surveys were drafted and submitted for approval of the Surveyor General before issuing to the surveyors in the field.

A close study was continued throughout the year of the trend of settlement, the discovery and development of mineral districts, and of the survey needs of the western provinces with a view to an intelligent preparation of a practical and economic scheme of surveys and of the parliamentary estimates.

The number of applications received to fill the positions of chief of party, assistant, articted pupil, and leveller was forty-six, an increase of only one.

Sixty-three accounts for expenditure in the field in connection with Dominion land surveys were received, examined, and passed for the approval of the Surveyor General. Six hundred additional accounts for the general expenses of the branch were examined and audited. The total expenditure involved was approximately \$700,000.

The survey equipment owned by this branch is valued at approximately \$85,000. A complete record of the distribution of this equipment in the spring to the various parties was made out and filed; in the fall, upon the close of field operations, the return of equipment by each surveyor was checked and statements prepared showing the place of storage, past service, and present condition or state of repair for each article. The outfits include two hundred and twenty horses and twenty-eight motor-cars and trucks, besides wagons, harness, and other articles necessary for transportation purposes. The proper supervision of this equipment involved extensive correspondence.

The clerical staff of the division kept attendance and leave of absence records and attended to the distribution of the pay cheques for the entire head office staff of the branch, which comprises one hundred and eighty-six employees. In addition they recorded the attendance of the field staff when employed at office work in Ottawa.

In all 5,800 draft letters and memoranda were prepared in this division.

#### SURVEYS INFORMATION DIVISION

The work carried on in this division of the office consists in general of the preparation of plans, sketches, and maps for the instruction of the chiefs of survey parties in the field, the dealing with technical correspondence relating to surveys, the registering of all returns furnished by the surveyors, the editing of the annual report of the branch, and of other special reports, and other miscellaneous technical work.

In the early days of the West when land was cheap and plentiful and very little fencing was done, the settlers were not greatly concerned over the boundaries of their lands. With the increase in population, however, land has become much more valuable, and boundary lines, especially within the more thickly settled districts, are now a very vital matter. Hence the volume of inquiries with reference to surveyed boundary lines, monuments lost or out of place, etc., keeps increasing from year to year. Last year showed a considerable increase over the previous ones.

Each year also the surveys are becoming more complex so that the work of preparing the plans and sketches for the instruction of the surveyors becomes increasingly difficult and complicated. During the past year more than 3,000 of these plans were prepared.

The amount of other parts of the regular work of the division was about the same as the previous year.



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The only new work undertaken was in connection with the final settlement of the Hudson's Bay Company's land claims. By the Deed of Surrender of 1870 the company was allowed one-twentieth of all land set out for settlement during the fifty years following the acceptance of the surrender within what was then known as the "fertile belt." The expiration of that period came in 1920 and in that connection this division undertook the work of determining accurately the area surveyed in each township within the "belt". This entailed a thorough examination of the plans of about 1,600 townships.

## EXAMINATION OF SURVEY RETURNS DIVISION

Owing to the decreased program of surveys in the field none of the stadia surveyors was required to assist in the preparation of the official plans of their work, the whole being undertaken by the staff of this division for the first time since the inception of stadia investigations in 1913.

The benefit of having the original records of subdivision surveys made in the field submitted along with the office copies has fully justified the procedure, as it is only rarely that it is now necessary to refer to the surveyor for an explanation of his method of survey or of his returns.

The mapping of the survey of lakes and rivers in unsubdivided districts was done in this division by means of the Universal protractor. The careful use of this instrument produces very dependable and surprisingly accurate results and has entirely displaced the method of latitudes and departures for the plotting of these surveys. Circuits of from ten to twenty-five miles were frequently found to close within an error of 1 in 2,000, which is doubtless quite as accurate as the instrumental work in the field.

The geographical base for a map of the Rice Lake mining district east of lake Winnipeg was prepared by a member of the office staff by the use of this instrument; a similar base for the map of Flinflon Lake mining district was prepared by the surveyor who made the survey, assisted by a member of the office staff, while the plots of lakes in northern Saskatchewan were made by an assistant on the exploratory survey party.

Progress report sketches from surveyors in the field to the number of eight hundred and sixteen were received and examined. The activity in the mining districts of Manitoba has continued to increase; the returns of survey of ninety-two mineral claims were received for examination. Triplicate plans were received in many cases. Work on the delimitation of the British Columbia-Alberta boundary was continued and returns of survey of the meridian of 120 degrees longitude across townships 74 and 78 to 84 inclusive, range 13, west of the Sixth meridian, were received and examined. Provincial road plans to the number of six hundred and thirty-six, having a mileage of 1,189, were received and examined. The work of adding to each road plan already received the number under which the plan is recorded in its respective Land Titles office in the province of Saskatchewan has been completed. Twenty-four railway plans comprising 332 miles of line were examined. In several cases four or five copies of the plan were submitted for examination, the total number of plans being fifty and the gross mileage 611.

Some nine hundred and seventy-four requests for information concerning surveys from other branches of the department and from the public were dealt with, involving the preparation of two hundred and ninety-eight sketches and the calculation of the areas of 1,434 parcels of land.

## DRAFTING AND PRINTING DIVISION

In other divisions of the branch returns of surveys are examined and plans compiled therefrom. The Drafting and Printing division prepares these for reproduction



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by carefully drawing them again so as to make a neat, clear copy. From this copy, by means of photography, a zinc plate is prepared which the lithographer uses to print an edition of the plan. The preparation of these copies constitutes the main work of the division, but other work closely related thereto is also undertaken as the staff is qualified and equipped for such work. The staff consists of draftsmen, stampers, and printers. The stampers put lettering on the bodies of plans by means of type; the printers set up the footnotes, titles, etc., for pasting on the plans.

### *Township Plans*

These constitute the largest part of the work. During the year eight hundred and thirty-seven township plans have been prepared of which two hundred and eleven were reprints of plans formerly lithographed in colours and of which the editions thus printed had become exhausted. The old system of lithographing was from stone and as the stones are costly and bulky it was impracticable to keep them for reprinting. Therefore when an edition of the old plans becomes exhausted it is necessary to make a new copy of the black for photographing. As this original is now preserved the printing of a future supply is simply a matter of photographing again to reproduce the black and making up the colours by lithography in the usual way.

### *Miscellaneous Surveys*

These comprise all irregular surveys of Dominion lands such as settlements, Indian reserves, timber berths, villa lots, subdivisions and townsites; seven such plans were dealt with. Three maps to show the results of soil surveys by as many different survey parties were also prepared. The areas mapped were in the Peace River district, the Porcupine and Pasquia forest reserves, and in the district lying west of lakes Winnipegosis and Manitoba.

### *Mounting Plans and Maps*

All plans and maps subject to much hard use soon become torn, even when printed upon the best quality of paper. To make them wear longer many of them are mounted upon cotton. The maps used by surveyors in the field are frequently mounted in sections so as to fold to fit the pocket. Maps and plans to the number of one hundred and fifty-three were mounted.

### *Topographical Maps*

There has been under consideration the publication of a series of topographical maps of uniform scale and size of sheet, laid out in regular fashion so that sheets may be indexed. This series would embrace all areas regarding which sufficient data have been collected by surveyors employed by the Topographical Surveys Branch.

### *Miscellaneous Jobs*

Next to township plans these are the most numerous. Under this heading may be noted five astronomical field tables, three maps to accompany Orders in Council, forty-five special editions of plans to accompany patents, eleven commissions and certificates for the Board of Examiners for Dominion Land Surveyors, seventy-three printing jobs consisting of small editions of forms, letters, etc., for office use, and one hundred and thirty-three other jobs of various kinds.



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*A New Dotting Pen*

Of interest to surveyors is a new dotting pen invented by Mr. W. A. Birchall, of the Topographical Surveys drafting staff. This pen depends on a principle entirely new in dotting pens, the dots being produced on exactly the same principle by which dots are made from type or brass rule by the ordinary printing press. Type ink is distributed evenly on a plate glass slab by means of a small composition roller. The pen itself has a very small roller of similar composition which swings on an arm to two positions. When in the first position it is rolled over the ink already distributed on the slab, thereby receiving on its surface a thin coating of ink. The roller is then swung into the second position where it is held by a small spring so as to lightly touch the teeth of a small dotting wheel. The teeth of this wheel pick up the ink and transfer it to the drafting paper giving the required dotted line. By varying the character of the teeth on the dotting wheel, which is done by providing different wheels, an almost endless variety of dotted lines may be obtained. In addition, continuous lines can be drawn to represent different classes of roads, or two parallel lines can be laid down with cross ties to represent railroads. In operation the pen is held against a straight-edge or curved guide. As the dotting wheel is small, it operates quite freely around curves.

The pen has been used for some time by Mr. Birchall, more particularly in the drawing of the revised sectional maps of the West now being undertaken. On these the dotted lines representing section and quarter-section lines, and lines representing the different classes of roads, telegraph, and telephone lines, steam and electric railroads, as well as combinations of railroads, telegraph lines and telephone lines, have all been put down by this pen.

A patent has been taken out by a firm of instrument-makers who are putting the pen on the market. As pointed out above, the pen uses printers' type ink, necessitating the use of a slab and auxiliary roller for spreading the ink evenly. The inventor is working at the perfection of a felt roller suitable for use with an ink similar to that in use for the ordinary rubber stamp. With the adoption of this roller Mr. Birchall hopes to be able to eliminate the auxiliary roller and inking slab, and to be able to do more lines with one inking of the roller. In fact, it is thought that for ordinary work one inking of the felt roller may do for weeks.

## SECTIONAL MAP DIVISION

*Compiling*

Until the present year the compilation of sectional maps has consisted of,—

1. Gathering information from plans, sketches, and reports of surveyors sent out by the branch on subdivision, base line and other surveys, and from maps and plans published by other branches of the Department of the Interior and also by other departments.
2. Reducing all plans to the common scale of two miles to one inch.
3. Transferring all information to accurate projections.

The "rough plans" thus prepared were photo-zincographed and prints made in light blue, which were used as bases for contours and also for the finished drawings.

Nine sheets were compiled by this method during the year and two others are in hand.

One of the defects of the maps produced in this way has been the lack of information about roads and trails, and it was realized that the only way to get this information was to send out survey parties to travel over the country covered by the



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maps which it was proposed to revise, and to classify the roads into four classes according to a prearranged standard. These parties would also note the positions of streams within the sections, bridges, houses and other buildings, wooded areas, telegraph and telephone lines, etc., and in addition would take numerous aneroid barometer readings with a view to working out contours for the sheets on their return to the office at the close of the season.

Five sheets were chosen for investigation in this way during the season of 1919, and on the return of the surveyors from the field in the fall, the compiling staff aided them in preparing revised plans of the districts investigated showing all information.

Surveyors' returns consisting of one hundred and fifty-three field books, thirty-four general reports, and 1,426 plots, sketches, and plans were examined with a view to preventing the duplication of names of topographical features, eliminating unsuitable names, and establishing spellings as approved by the rules of the Geographic Board.

Surveyors employed in the revision of sectional maps require with their instructions copies of the township plans covering the areas to be investigated. These plans must be brought up to date by the addition, by hand, of all surveys of roads, railroads, and water areas made since the last editions of the township plans were printed. The addition of this information to about 850 townships plans covering seven sectional maps was in hand at the close of the year.

Additional work included the drafting of letters to surveyors in regard to place-names, and to railway officials and others to secure information for sectional maps. A number of odd jobs in compiling and checking of maps were also undertaken.

### *Mapping*

During the past year the general style of the sectional maps has been revised to comply as nearly as practicable with the regulations of the International Map Committee, and also to add more information useful to the public. Roads are being shown in four classes, according to their condition; isolated buildings are also being shown and their characters distinguished by symbols; these and several other items of useful information entail additional colours and the making of separate drawings for each colour.

The stamping of names that was adopted last year has proved satisfactory and is being continued, and the same method is being applied to the use of conventional symbols.

A great saving of time has been effected by the use of an improvement on dotting-wheels invented by Mr. W. A. Birchall of this branch, a description of which is given on page 33 of this report.

In addition to the sectional map work, the manuscript drawings of the additional portions of the boundary between the provinces of Alberta and British Columbia were completed for printing.

### SPECIAL SURVEYS DIVISION

#### *Governing Surveys*

The only new surveys of governing lines made during the past year in addition to the establishment of a portion of the British Columbia-Alberta boundary were a few miles of the Manitoba-Saskatchewan boundary and a base closing.

*Retracement of Governing Surveys.*—As a result of the differences of latitude between the positions of monuments on the Principal meridian and those of corresponding monuments on the Second meridian, all lines closing on the Second meridian from the east carry deflections ranging from five to twenty-three chains. These surveys were made between 1870 and 1882 when the regulations provided that the bearings of all lines should be recorded as north, south, east, or west. The true



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bearings of these closing lines, with a few exceptions, are therefore unrecorded, and the difficulty of determining how the lines are on the ground necessitated some retracement. Correction lines as far north as township 10 have been retraced through two, or in some cases three ranges immediately east of the Second meridian.

Base line closings along the Second meridian south of township 32 have indicated that the chainage along this portion of the meridian is long. That this is so is further indicated by a tie to the North American Datum system at the international boundary. A retracement of the Second meridian from the international boundary to township 24 was begun.

*Revision of Sectional Maps*

It has been felt for some time that our sectional maps might be very much improved and their usefulness very materially enhanced by the addition of information obtainable at small extra expense. During the past season some parties have been engaged in the field in procuring additional information respecting roads, buildings, improvements, elevations, and other topographical features for the purpose of converting our sectional sheets into topographical maps. Instructions for this work were prepared in this division.

Control elevations for the necessary topographic work were provided principally from the records of the level work of this branch and from the railway profiles. The railway profiles when adjusted to mean sea-level datum provide the elevations of all road crossings and natural features along the railways; this work alone entailed the searching of records and the examination of railway plans and profiles over more than 3,200 miles of line. Besides the above, use was made of the levels run by the Geodetic Survey, the Reclamation Service, and the different provincial and municipal authorities.

In this way each surveyor was provided by the office with a very large number of known elevations which enabled him to dispense largely with the necessity for running spirit-levels and to rely upon his barometers, controlling them by very frequent checks upon known elevations.

*Astronomical Work*

*Astronomical Field Tables.*—The four sets of tables for the position of Polaris and the table giving the right ascension and declination of the sun were computed and printed as usual. Two of the former give the azimuth of Polaris for every twentieth township, while the other two give it for every second degree of latitude up to 56 degrees. The periods covered by these tables are:—

October 9 to December 19, 1920.

August 19 to October 11, 1921.

June 9 to August 24, 1922.

and

December 20, 1920, to March 14, 1921.

March 13 to June 8, 1922.

*Magnetic Surveys*

During the past season some thirty-five surveyors were instructed to observe for magnetic declination, and each surveyor was supplied with a list of stations founded previously in the neighbourhood of his work at which repeat observations might be made. Some nine hundred declination observations, including about fifty repeat observations, were obtained during the season. On the surveys of R. C. Purser, D.L.S., and G. H. Blanchet, D.L.S., observations for magnetic dip and total force were taken at twenty stations, including three repeat stations founded by the Carnegie Institution of Washington and the Topographical Surveys Branch.



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These observations for magnetic dip and force with the results obtained from the repeat observations, and the repeat observations obtained at some sixty declination repeat stations taken during 1918 will appear in the Journal of the Royal Astronomical Society of Canada.

All observations for declination, dip, and force have been reduced to International Magnetic Standard by direct comparison at the beginning and end of the season with the magnetic standards at the Magnetic Observatory, Agincourt, by courtesy of the Director of the Meteorological Service of Canada. The declination observations have been reduced to mean of month by direct comparison with the continuous declination magnetograms of the Magnetic Observatory at Meanook, Alberta, supplied by the Director of the Meteorological Service of Canada.

Considerable progress has been made in compiling a catalogue of magnetic observations made by this branch, which will be issued in monograph form.

A study covering deviation of magnetic declination in Western Canada has been made in an endeavour to correlate the magnetic deviation and the variation of geologic formations. A short abstract will appear in the Journal of the Royal Astronomical Society of Canada.

Several hundred magnetic maps were distributed to applicants during the season, and many questions on magnetic subjects were answered for correspondents.

Considerable work in secular variation, deviations, disturbances, etc., has been accomplished.

#### *Surveying Instruments*

Repairs were made to sixty-nine transits, twenty-five levels, eight level rods, twenty-six aneroid barometers, ten kodaks, twenty-two instrument cases, eight tripods, and twenty-three miscellaneous instruments. Eleven sidereal watches were overhauled and readjusted.

In connection with the inspection of instruments and outfitting of surveyors, two hundred and ninety-one cases aggregating seven tons (13,872 pounds) were shipped from this office, and two hundred and twenty-one cases weighing 12,374 pounds received.

A statement of instruments on hand on March 31, 1920, showing also the instruments purchased and sold during the year is given in appendix No. 5 to this report.

#### *Miscellaneous Work*

Engraved brass plates for concrete monuments were supplied for the Alberta-British Columbia interprovincial boundary survey as in previous years; also samples of our survey posts in different stages of manufacture were supplied to the Department of Lands, Forests, and Mines of Ontario, and the Department of Public Works of Manitoba, together with an explanation of various points in connection therewith.

A new nomogram was designed and published entitled "Nomogram showing Duration of Sunlight for Every Day in the Year for all Places between Latitudes  $25^{\circ}$  N. and  $60^{\circ}$  N.," which supersedes the one previously published extending from  $40^{\circ}$  to  $60^{\circ}$  N. An explanation and discussion of this kind of nomogram was published by this branch in the Journal of the Royal Astronomical Society of Canada, 1919.

A nomogram was designed and published entitled, "Nomogram for Use in Sunlight Engineering showing Azimuth and Length of Shadow for Any Time of Day for Any Day in the Year for Any Latitude."

The two above nomograms were distributed to members of the Canadian Town Planning Institute and other interested parties.

A nomogram was designed entitled, "Nomogram for Calculating Latitudes and Departures, giving Both Distances with One Setting of the Straight-Edge".



## SESSIONAL PAPER No. 25a

A pamphlet entitled "Notes on Soils" was published, covering matter relevant to the soil survey being carried on by this branch.

## SURVEYS LABORATORY

In previous reports attention has been drawn to the serious congestion, due to lack of space, at the Surveys Laboratory, which has greatly hampered the efficient performance of the testing and other work. Fortunately the opportunity recently presented itself of taking over some rooms in the building next door to the laboratory. It is intended to transfer the aneroid testing appliances to one of the new rooms which will be used exclusively for this important branch of the work. Another room will be devoted to thermometer testing and office space. The following is a short account of the work accomplished by the various sections in the period covered by this report.

*Metrology*

The base has been verified thirty-six times with the 4<sup>m</sup> rule and the laboratory standard tapes and wires were compared with the base two hundred and thirteen and seventy-two times respectively. The long delayed 1<sup>m</sup> invar rule arrived during the summer of 1919. Owing to the nature of invar and the unknown conditions to which the rule had been exposed in transit from France after its standardization at the International Bureau of Weights and Measures, it was deemed advisable to have the length of the rule verified at the Bureau of Standards, Washington, by comparison with the United States platinum iridium prototype metre. This test was made, the rule being taken to and from Washington by one of the staff in order to avoid shocks or other adverse treatment during the journey. Twelve comparisons of the 4<sup>m</sup> rule with the 1<sup>m</sup> rule were made. The length of the 4<sup>m</sup> rule thus determined confirmed, within the limits of error previously considered probable, the length obtained from the verification of the standard tapes sent to Washington in previous years.

In anticipation of the arrival of the 1<sup>m</sup> nickel and 1<sup>m</sup> forty-two per cent nickel-steel rules on order, designs have been prepared and construction started on a new one-metre comparator. This comparator is necessary in order that the various rules may be studied and compared among themselves. It is also designed so that when completed, besides being used for the comparison of the lengths of two rules, absolute determinations of the coefficients of expansion of the rules can be made with it.

The lengths and weights of thirty tapes of all kinds were determined and twelve precise level rods and one sounding gauge were tested.

*Transits, Levels, Etc.*

Tests were made of ninety D.L.S. transits, forty-five levels, thirty-eight compasses, one hundred and thirty-five aneroid barometers, six surveying cameras, forty-three watches, eleven Abney levels, four stormographs, twelve telescopes, and two binoculars.

*Thermometers*

Further additions have been made to this section which is now equipped for the complete study and testing of thermometers in the range 0°C. to 350°C. to the highest limits of precision. An electrical resistance thermometer has been obtained which forms an important addition to the laboratory standards. The hypsometer has been received and set up and drawings were prepared for a high temperature, oil bath comparator of original design. This piece of apparatus is now constructed and it is hoped will soon be installed in the new room previously mentioned, which will house the thermometer testing section. A bulletin has been prepared and is now nearly ready for publication describing the tests conducted by this section.



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*Aneroids*

The aneroid section has been fully employed during most of the year. Besides instruments for the Topographical Surveys Branch, a large number of aneroids were received for test and adjustment from other sources. In particular, a large amount of time was spent on testing and adjusting the aneroids of the Geodetic Survey of Canada. The results obtained with aneroids in the field amply justified the advantage of employing instruments carefully tested and adjusted, the constants of which were known. The policy of buying on approval was also proven to be founded on a sound basis. All aneroids are now purchased on condition that they will pass the laboratory tests, and the standard of the instruments issued to surveyors is thus maintained at a high level.

*Watches*

Further experiments have been devoted to the development of the short test. This test was used exclusively for the forty-three watches tested during the year. It was found that by suitably choosing the tolerances that the short test gave a reliable indication of the performance of the watch, with a great saving of the time taken up by the test. The whole test occupies only twenty days, the watch being rated two days in each of the five positions and at the three temperatures; an isochronism test is also included. This short test should be of immense service to interested parties who desire to know the qualities of watches purchased or in use by them.

Of the forty-three watches tested, ten, that is twenty-three per cent, passed.

## PHOTOGRAPHIC OFFICE

During the year eight hundred and fifty photographic plates furnished by surveyors engaged on photo-topographical surveys were developed by the staff of general photographers. From the negatives, plotting enlargements were made and in addition two sets of contact prints which were mounted in albums and indexed.

An increase over the previous year in the number of films developed and contact prints made was due to the more general use of the small-size pocket kodak by surveyors in the field. All negatives were indexed and one set of prints mounted in albums for office use. Extra prints as required were furnished to the surveyors for the purpose of illustrating their general reports. A marked improvement is noted in the quality of the photographs taken by surveyors during the past season.

The staff of the photo-mechanical plant returned to more nearly a normal basis, one member resuming his duties after service overseas, and two apprentices having gained more experience and a more practical knowledge of the work. As a result the demands of the other divisions of the branch were more adequately met than was possible during the previous year.

The work of this branch of the office shows an increase over the previous year particularly in the output of photo-lithographic plates. The number of Vandyke and blueprints is considerably in excess of that turned out in any previous year owing chiefly to the number of blueprints of various maps, plans, etc., required for comparison with originals or rough copies prior to the making of the photo-lithographic plates.

Details and figures of the work executed are given in appendix No. 4.

## LITHOGRAPHIC OFFICE

The main purpose of this division is to print township plans and sectional maps, but advantage is taken of its existence for printing numerous forms used on the surveys and at head office, the index map, skeleton forms to be inked in by draftsmen, a few topographical maps and general lithographic work for other branches and departments.



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The numbers of township plans and sectional maps printed show increases of thirty-eight and thirty-one per cent respectively as compared with the previous year while, due to decreased production and a maximum reduction in the number of copies of small forms printed during the previous year, the stocks of which became depleted, the number of sundry jobs was increased three hundred and five per cent.

The estimated cost of this work for the last two years at Printing Bureau rates, or what it would have cost the Government to have the work done through the Bureau, is shown in the following table:—

ITEM	Number Printed		Cost at Bureau Rates	
	1918-19	1919-20	1918-19	1919-20
Township plans.....	736	1,020	\$ 22,619 50	cts. 42,251 42
Sectional maps.....	57	75	4,575 30	4,338 79
Sundry jobs.....	232	940	10,963 71	24,230 60
	1,025	2,035	38,158 51	70,820 81

Adding to this the cost of the paper and percentage for handling allowed by the Bureau (\$4,174.45 and \$6,125.80) would give totals of \$42,332.96 and \$76,946.61 respectively.

In calculating the actual cost to the department for maintenance of this division, it is necessary to take into account not only the actual payments by the department for salaries, materials, etc., but also general overhead expenses, such as rent, light, power, heat, cleaning, etc. An allowance must also be made for depreciation of the plant and interest on its value, also for fire insurance. The cost comes out as follows:

	1918-19	1919-20
	\$ cts.	\$ cts.
Process Photographers—		
Chemicals, glass, stationery, etc.....	1,235 72	1,260 86
Rent, light, heat, cleaning, etc.....	1,014 71	1,000 34
Interest and depreciation.....	577 25	577 25
Insurance.....	12 51	12 51
Salaries.....	8,409 68	10,715 93
	11,249 87	13,566 89
Less one-third for time on other than lithographic work.....	3,749 96	4,522 30
Total.....	7,499 91	9,044 59
Lithographers—		
Supplies.....	2,908 19	1,630 07
Rent and Power.....	963 00	1,041 02
Paper.....	4,174 45	4,381 24
Interest and depreciation.....	2,772 61	2,772 61
Insurance.....	60 07	60 07
Wages.....	13,178 12	13,642 27
Total.....	24,056 44	23,527 28
SUMMARY		
Process photographers.....	7,499 91	9,044 59
Lithographers.....	24,056 44	23,527 28
Total.....	31,556 35	32,571 87
Value of work at Bureau rates.....	42,332 96	76,946 61
Saving.....	10,776 61	44,374 74



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It might be inferred from this large saving that the Printing Bureau pays too much to lithographic firms for their work and that their rates are too high, but diligent inquiry has shown that such is not the case. The Printing Bureau rates are, if anything, below the average commercial rates. The success of the Surveys' lithographic plant is due to efficiency of organization and the perfection of an equipment specially adapted to a restricted class of printing.

## GEOGRAPHIC BOARD

The Geographic Board, of which the secretary is an officer of the Department of the Interior, published its sixteenth report containing the decisions between April 1, 1917, and March 31, 1919. The report is a supplement to the fifteenth report issued in 1917, which contained all decisions from the inauguration of the board to March 31, 1917.

## BOARD OF EXAMINERS FOR DOMINION LAND SURVEYORS

The Board of Examiners for Dominion Land Surveyors held four meetings.

The first was a special meeting lasting from April 28, 1919, to May 15, 1919 (inclusive), during which examinations were held at Ottawa and Winnipeg, the second was a special meeting lasting from August 20, 1919, to September 1, 1919, and the third was a special meeting held on October 28, 1919. The fourth was the regular annual meeting called for by section 9 of the Dominion Lands Surveys Act. It began on Monday, February 9, 1920, and lasted until March 12, 1920. During this meeting examinations were held at Ottawa, Calgary, and Edmonton.

The total number of candidates who presented themselves at the examinations was forty-eight. Of these, eleven tried the full preliminary examination, sixteen tried the final examination, twenty tried the leveller's examination, and one tried the examination for Dominion topographical surveyors.

Four candidates were successful at the full preliminary examination, as follows:—

Currie, Percival Norman Wallace, Montreal, Que.

Forward, Francis Arthur, Ottawa, Ont.

Paterson, David Roy, Ottawa, Ont.

Roberts, Stanley Oxley, Ottawa, Ont.

Nine candidates were successful at the final examination as follows:—

Bannister, George William, Ottawa, Ont.

Biddell, Cecil Henry, Winnipeg, Man.

Bradley, Nicholas Hilburn, Calgary, Alta.

Calder, Leslie Raymond, Calgary, Alta.

Coughlan, John Q., Ottawa, Ont.

Gordon, Samuel Heber, Ottawa, Ont.

Robertson, Douglas Mills, Edmonton, Alta.

Sharpe, David Neville, Winnipeg, Man.

Van Patter, Hugh Stanley, Ottawa, Ont.

Nine candidates were successful at the leveller's examination as follows:—

Blair, Stanley Martin, Edmonton, Alta.

Carmichael, Harvey, Edmonton, Alta.

Hunter, Eldred T., Edmonton, Alta.

Jaffray, Stuart King, Edmonton, Alta.



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Jarrett, George Sinclair, Edmonton, Alta.

McDonald, William Leslie, Edmonton, Alta.

McLeod, Donald, Edmonton, Alta.

Reid, Charles D., Edmonton, Alta.

Webb, Henry Randall, Edmonton, Alta.

One candidate was successful at the examination for Dominion topographical surveyors, namely:

Ratz, John Earl, Ottawa, Ont.

The time of the board during the meetings was largely taken up with the reading and valuation of the candidates' answer papers. The board was also occupied in framing amendments to the Dominion Lands Surveys Act and the Rules and Regulations of the Board of Examiners for Dominion Land Surveyors. A new program of subjects was drawn up and the respective text books for their preparation selected and recommended. Complete sets of question papers to be used at the following examination were also prepared. In addition to this the evidence submitted by candidates at the final examination in proof of their eligibility therefor had to be examined. This evidence consisted of certificates of provincial land surveyors and of affidavits of service under articles of apprenticeship.

Twelve commissions were issued to candidates who had passed the final examination and had furnished oaths of office and allegiance, and bonds for the sum of one thousand dollars as required by section 25 of the Dominion Lands Surveys Act.

Five certificates of preliminary examination were issued to successful candidates who had complied with the requirements of the law.

One certificate of Dominion topographical surveyor was issued to a candidate who had successfully passed the examination and complied with the requirements of the law.

Nine certificates as levellers were issued to candidates who had successfully passed the examination.

Section 35 of the Dominion Lands Surveys Act provides that every Dominion land surveyor shall be in possession of a subsidiary standard of length and that such standards are to be tested by the department at least once every four years. During the year nine new standards were issued to surveyors, and one new measure which had previously been supplied was tested by the department.

A new edition of the rules and regulations was prepared during the year. This new edition (tenth) contains many changes both in the regulations and subjects of the different examinations.

Examinations for levellers are now conducted under the jurisdiction of the board and levellers' certificates are issued by its direction.



APPENDIX No. 1

AREA OF SURVEYED LAND IN MANITOBA, SASKATCHEWAN, AND ALBERTA.

Period	Acres	Number of Farms of 160 Acres each
Previous to June, 1873.....	4,792,292	29,952
1874.....	4,237,864	26,487
1875.....	665,000	4,156
1876.....	420,507	2,628
1877.....	231,691	1,448
1878.....	306,936	1,918
1879.....	1,130,482	7,066
1880.....	4,472,000	27,950
1881.....	8,147,000	50,919
1882.....	10,186,000	63,662
1883.....	27,234,000	170,212
1884.....	6,435,000	40,218
1885.....	391,080	2,448
1886.....	1,379,010	8,620
1887.....	643,710	4,023
1888.....	1,131,840	7,074
1889.....	516,968	3,231
1890.....	817,075	5,106
1891.....	76,560	476
1892.....	1,395,200	8,720
1893.....	2,928,640	18,304
1894.....	300,240	1,876
1895.....	406,240	2,539
1896.....	506,560	3,166
1897.....	428,640	2,679
1898.....	859,840	5,374
1899.....	1,022,720	6,392
1900 (first 6 months).....	735,480	4,596
1900-1901.....	1,603,680	10,023
1901-1902.....	2,553,120	15,957
1902-1903.....	6,173,440	38,584
1903-1904.....	12,709,600	79,435
1904-1905.....	10,671,520	66,697
1905-1906.....	4,973,920	31,087
1906-1907 (9 months).....	3,819,700	23,873
1907-1908.....	6,123,040	38,269
1908-1909.....	7,412,870	46,330
1909-1910.....	7,423,200	46,395
1910-1911.....	5,683,200	35,520
1911-1912.....	5,146,080	32,163
1912-1913.....	5,155,520	32,222
1913-1914.....	5,193,280	32,458
1914-1915.....	4,484,960	28,031
1915-1916.....	3,112,640	19,454
1916-1917.....	2,221,280	13,883
1917-1918.....	1,323,360	8,271
1918-1919.....	91,520	572
1919-1920.....	317,920	1,987
	177,993,025	1,112,451



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## APPENDIX No. 2

## SCHEDULE of surveyors employed and work executed by them:—

Akins, J. R., Ottawa, Ontario—

Topographical mapping surveys for the revision of the Blackfoot sectional map, comprising townships 17 to 24, ranges 16 to 30 west of the Fourth meridian.

Alexander, J. B., Calgary, Alberta—

Levelling along the 7th base line from range 14 west of the Second meridian to the Fourth meridian; along the 7th base from range 12 to range 29 west of the Fourth meridian, 371 miles.

Bennett, G. A., Tillsonburg, Ontario—

Stadia surveys in tp. 15-19-Pr.; tps. 9 to 16-20-Pr.; tps. 9 to 16-21-Pr.; tps. 9 to 17-22-Pr.; tps. 9 to 17-23-Pr.; tps. 9 to 16-24-Pr.; tps. 9 to 16-25-Pr.; tps. 9 to 16-26-Pr.; tps. 9 to 16-27-Pr.; tps. 9 to 16-28-Pr.; tps. 9 to 16-29-Pr.; tps. 15 and 16-32-Pr.; tps. 14 to 16-33-Pr.; tps. 13 and 14-34-Pr.; tps. 13 to 16-1-2; tps. 13 to 16-2-2; tps. 13 to 17-3-2; tps. 13 to 16-4-2; tps. 13 to 16-5-2; tps. 15 and 16-6-2.

Berry, E. W., Meaford, Ontario—

Precise levelling along Canadian Pacific railway from Assiniboia to Moose Jaw, 68 miles. Levelling along 4th base line across ranges 7 to 28 west of the Second meridian, 132 miles.

Blanchet, G. H., Ottawa, Ontario—

Exploration and traverse of larger lakes and rivers of the district between Montreal lake and Ile-à-la-Crosse lake. Investigation of Dillon river valley. Location of the road from Big River to the Grand rapids on Beaver river; colonization road from La-Plonge to Big River; Montreal road from Montreal lake to Prince Albert.

Roulton, W. J., Wallaceburg, Ontario—

Topographical mapping survey for the revision of the Saskatoon sectional map, comprising townships 33 to 40 ranges 1 to 14 west of the Third meridian. Miscellaneous surveys in tp. 39-1-3 and tp. 40-14-3.

Bowman, E. P., West Montrose, Ontario—

Subdivision in Porcupine forest reserve of portions of tps. 43 and 44-2-2; tps. 43 and 44-3-2; tps. 41 to 44-8-2; tps. 43 and 44-9-2.

Brenot, L., Ottawa, Ontario—

Investigation of sixty-nine townships for soldier settlement purposes between Peace and Whitemud rivers west of the town of Peace River; also twenty-seven townships west of Grande Prairie settlement.

Bridgland, M. P., Calgary, Alberta—

Photo-topographical survey of the north part of Bow River forest reserve and the south part of Clearwater forest reserve.

Buchanan, J. A., Edmonton, Alberta—

Retracement of school lands in tps. 44 to 47-23-4; tps. 46 and 47-24-4; tps. 46 and 47-25-4; tps. 45 to 47-26-4; tps. 45 and 47-27-4; tp. 47-28-4. Subdivision in tp. 50-27-5.

Cautley, R. W., Edmonton, Alberta—

Survey of the 120th meridian (Interprovincial Boundary) through townships 74 and 78 to 84.

Christie, W., Prince Albert, Saskatchewan—

Investigation of lands for general settlement in sixty townships along the Canadian Northern railway westerly from Hudson Bay Junction.

Cote, J. M., Ottawa, Ontario—

Investigation and retracement of school lands in tp. 14-7-3; tps. 12 to 15, 17 and 18-12-3; tps. 12 to 14, 17 and 18-13-3; tps. 10, 12 to 15, 17 and 18-14-3.

Cowper, G. C., Ottawa, Ontario—

Stadia surveys in tps. 1 to 10-1-4; tps. 2 to 7, 9, and 10-2-4; tps. 2 to 7, 9 and 10-3-4; tps. 2 to 8 and 10-4-4; tps. 1 to 7, 9, and 10-5-4; tps. 1 to 8, and 10-6-4; tps. 1, 2 and 6 to 10-7-4; tps. 1, 2, 6 to 8 and 10 to 12-8-4; tps. 1, 2, 4 and 6 to 12-9-4; tps. 1 to 12-10-4; tps. 1 to 8-11-4; tps. 1, 4, 7, 8, 10, and 11-12-4; tps. 1 to 3, 7, 8, and 11-13-4; tps. 1, 2, 8, 10, and 11-14-4; tps. 1, 2, and 11-15-4; tps. 1 to 3-16-4; tps. 1 to 6-17-4; tps. 3 to 6-18-4; tps. 3, 5 and 6-19-4; tps. 5 and 6-20-4; tps. 5 and 6-21-4; tps. 5 and 6-22-4; tps. 5 and 6-23-4.

Cumming, A. L., Cornwall, Ontario—

Subdivision in the Porcupine forest reserve in tp. 45-30-Pr.; tps. 41 and 42-9-2; tps. 41 and 42-10-2; stadia surveys in tp. 41-8-2; tp. 43-9-2; tp. 43-10-2. Locating and building a portion of the road from Prairie River to the settlement in Porcupine forest reserve.

Dozois, L. O. R., Calgary, Alberta—

Precise levelling along Canadian Pacific railway from Lacombe, via Kerrobert to Eyebrow, 402 miles.



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## Evans, S. L., Corinth, Ontario—

Subdivision in tp. 63-16-Pr.; tp. 63-17-Pr.; tps. 62 and 63-18-Pr.; tps. 47, 52, and 53-5-3; tps. 46, 47, and 52-6-3; tp. 52-7-3; tp. 52-8-3. Stadia surveys in tp. 62-19-Pr.; tp. 53-4-3; tp. 42-5-3; tp. 47-7-3.

## Fawcett, S. D., Ottawa, Ontario—

Investigation of land for Soldier Settlement Board between lake Manitoba and lake Winnipegosis, and also along the Canadian Northern railway from township 23 to township 38.

## Fontaine, L. E., Levis, Quebec—

Retracement of school lands in tps. 13 to 16-16-2; tps. 13 to 17-17-2; tp. 13-18-2; tps. 13, 14, and 17-19-2; tp. 16-20-2; tps. 15 and 16-21-2; tps. 13, 14, and 17 to 19-22-2.

## Glover, A. E., Edmonton, Alberta—

Retracement surveys in tp. 17-31-Pr.; tp. 17-32-Pr.; tp. 14-28-2; tp. 15-1-3; tp. 14-2-3; tp. 18-4-3; tp. 21-7-3; tps. 20 and 21-9-3; tp. 17-17-3; tp. 15-18-3; tp. 17-19-3; tps. 10 and 11-22-3; tps. 21 and 22-1-4; tp. 1-7-4; tp. 10-19-4; tps. 1, 10, and 11-21-4.

Correction survey in tp. 20-9-3; tp. 10-25-3; tp. 9-28-3; tp. 24-9-5.

Stadia survey in tp. 21-30-Pr.; tp. 2-24-4; tp. 3-27-4; tp. 5-28-4; tp. 10-2-5.

## Herriot, G. H., Winnipeg, Manitoba—

Topographical mapping surveys for the revision of the Winnipeg sectional sheet comprising townships 9 to 16, range 11 east of the Principal meridian to range 4 west of the Principal meridian.

## Jackson, J. E., Hamilton, Ontario—

Subdivision of tp. 42-6-2; tp. 42-7-2. Part subdivision of tps. 41, 43, and 44-6-2; tps. 41, 43, and 44-7-2; tps. 42 and 43-9-2. Stadia survey in tp. 42-10-2.

## Johnston, W. J., Vancouver, British Columbia—

Part subdivision of tp. 24-19-5; tps. 27 and 28-22-5; tps. 27, 28, 29, and 30-23-5; tp. 29-24-5; tp. 27-2-6; tp. 23-3-6; tp. 22-4-6; tp. 22-5-6; tp. 19-8-6. Traverse in townships 27 and 28-22-5; tp. 29-23-5; tp. 22-4-6. Survey of the north limit of the railway belt in tp. 27-2-6.

## King, J. A. S., Ottawa, Ontario—

Subdivision of tp. 105-16-5. Part subdivision of tp. 66-2-5; tps. 104 and 105-15-5; tp. 106-16-5. Stadia survey in tp. 106-15-5.

## Knight, R. H., Edmonton, Alberta—

Subdivision of tp. 81-15-6. Part subdivision of tps. 76 and 79-7-6; tps. 76 and 80-8-6. Posting in tps. 79 and 81-16-6; tp. 81-17-6. Investigation in tp. 81-8-6.

## LeBlanc, P. M. H., Ottawa, Ontario—

Stadia survey in tp. 29-30-Pr.; tps. 28 to 30-31-Pr.; tps. 28 to 30-5-2; tps. 29 and 30-6-2; tps. 29, 30, 35, and 36-7-2; tps. 30 and 32 to 37-8-2; tps. 30 to 38-9-2; tps. 31 and 34 to 38-10-2; tps. 32 to 38-11-2; tps. 34 to 38-12-2; tps. 34 to 38-13-2.

## Lonergan, G. J., Buckingham, Quebec—

Inspection of survey parties under the following Dominion Land Surveyors:

On stadia surveys, Cowper, G. C., LeBlanc, P. M. H., McGarry, P. J., Norrish, W. H., Rinfret, C., Soars, H. M. R.

On school lands investigation, Cote, J. M., Fontaine, L. E., Walker, C. M.

On investigation of land for Soldier Settlement Board, Brenot, L., Fawcett, S. D.

On investigation of land for general settlement, McEwen, D. F.

On subdivision, King, J. A. S., Knight, R. H., Seibert, F. V., Stewart, N. C., Vicars, John.

On levelling, Alexander, J. B., Montgomery, R. H.

On miscellaneous surveys, Glover, A. E., Martindale, E. S., McKay, R. B.

## Martindale, E. S., Aylmer, Ontario—

Subdivision of dried-up lake beds in tps. 18 and 19-4-E; tp. 15-9-Pr.; tp. 32-32-Pr.

Investigation of water areas in tp. 15-2-Pr.; tp. 15-3-Pr.; tp. 18-5-Pr.; tp. 6-26-Pr.

Retracement in tp. 15-11-E; tp. 16-1-Pr.; tp. 16-2-Pr.; tp. 13-6-Pr.; tp. 20-7-Pr.; tp. 15-11-Pr.; tp. 7-14-Pr.; tp. 17-15-Pr.; tp. 7-24-Pr.

Survey of settlement lots in tp. 54-20-Pr.; and villa lots at Waterton Lakes park in tp. 1-30-4.

## Montgomery, R. H., Prince Albert, Saskatchewan—

Levelling along 11th base line from the Third to the Fourth meridian; the 13th base across ranges 12 to 28 west of the Fourth meridian; all outlines of township 38 across ranges 6 to 12 west of the Third meridian, 403 miles.

## McEwen, D. F., Edmonton, Alberta—

Investigation of lands for general settlement north of Battleford from Meadow lake westerly to the Fourth meridian and also north of Edmonton from lac la Biche westerly to the Fifth meridian.

## McGarry, P. J., Merritton, Ontario—

Stadia surveys in tps. 23 and 24-10-Pr.; tps. 24 to 26-11-Pr.; tps. 22, 23, 27, and 28-12-Pr.; tp. 27-13-Pr.; tps. 21 and 22-14-Pr.; tps. 24 and 26-16-Pr.; tp. 48-23-2; tps. 47 to 49-24-2; tps. 46 to 48-25-2; tp. 50-26-2; tps. 50 and 52-3-3; tps. 46, 47, and 48-4-3;

Retracement of river lots in St. Laurent settlement, in tps. 42 to 44-1-3.

## McKay, R. B., Vancouver, British Columbia—

Retracement survey in tp. 7-32-Pr.; tps. 2, 3, 6, and 7-33-Pr.; tps. 2, 6, 7, 10 and 11-34-Pr.; tp. 30-17-2; tp. 30-20-2; tp. 32-3-3.

Retracement of the Second meridian from the international boundary to the third correction line. Traverse in tp. 28-23-2.



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Norrish, W. H., Ottawa, Ontario—

Stadia surveys in tps. 14 to 16-4-E; tps. 15 and 16-5-E; tps. 15 and 16-6-E; tp. 22-13-4; tps. 22 to 31-14-4; tps. 24 to 31-15-4; tps. 28-16-4.

Reconnaissance survey for Soldier Settlement Board northeast of Prince Albert, near Whitecourt, and near St. Paul de Metis.

Narraway, A. M., Ottawa, Ontario—

Inspection of survey parties under the following Dominion Land Surveyors:

On soldier settlement surveys: Fawcett, S. D.

On subdivision: Bowman, E. P., Cumming, A. L., Jackson, J. E.

On general settlement surveys: Christie, W.

On revision of sectional maps: Akins, J. R., Boulton, W. J., Herriot, G. H., Palmer, P. E., Pierce, J. W., Scott, W. A.

On retracement of school lands: Buchanan, J. A., Cote, J. M., Fontaine, L. E., Pearson, H. E., Taggart, C. H., Walker, C. M.

On stadia surveys: Bennett, G. A., Norrish, W. H., Rinfret, C.

On levelling: Berry, E. W., Read, H. E.

On miscellaneous surveys: Purser, R. C.

Palmer, P. E., Ottawa, Ontario—

Topographical mapping survey for the revision of the Moose Mountain and Qu'Appelle sectional maps comprising townships 9 to 24 ranges 1 to 15 west of the Second meridian.

Miscellaneous surveys in tp. 19A-2-2; tp. 19-7-2; tps. 21, 22, 23, and 25-11-2; tps. 16, 20 and 21-13-2.

Pearson, H. E., Edmonton, Alberta—

Retracement of school lands in tp. 10-15-Pr.; tp. 11-16-Pr.; tps. 9, 10, 13, 14, and 15-17-Pr.; tps. 10, 11, 14, and 16-18-Pr.

Pierce, J. W., Ottawa, Ontario—

Topographical mapping surveys for the revision of the Edmonton sectional map comprising townships 49 to 56 ranges 15 to 28 west of the Fourth meridian.

Purser, R. C., Ottawa, Ontario—

Correction survey in tp. 32-2-2; tp. 35-21-2; tp. 35-22-2; tp. 31-3-3; tp. 53-21-3.

Traverse in tp. 33-1-2; tp. 42-21-2; tp. 42-15-3; tp. 55-6-4; tps. 64 and 65-21-4; tp. 39-27-4.

Retracement survey in tp. 32-1-2; tp. 29-2-2; tp. 29-3-2; tps. 38 and 43-17-2; tp. 38-18-2; tp. 42-24-2; tp. 47-25-2; tp. 44-26-2; tps. 47 and 48-12-3; tps. 46 and 47-24-3; tp. 34-25-3; tps. 39 and 40-27-3; tp. 54-6-4; tp. 37-19-4; tp. 37-20-4; tp. 59-4-5.

Plunkett, T. H., Meaford, Ontario—

Survey of the east boundary of tps. 61 and 62-30-Pr.

Survey of the 17th base line across ranges 27, 28, and 29, and the 18th base across range 30 west of the Principal meridian.

Stadia traverse and investigation in tp. 65-27-Pr.; tps. 63, 64, and 65-28-Pr.; tps. 64, 65, 66, and 67-29-Pr.; tps. 64, 65, 66, and 67-30-Pr.

Miscellaneous surveys in tps. 61, and 63-29-Pr.

Rinfret, C., Ottawa, Ontario—

Stadia surveys in tp. 9-29-Pr.; tps. 9 to 16-30-Pr.; tps. 8 to 16-31-Pr.; tps. 9 to 14-32-Pr.; tps. 8 to 14-33-Pr.; tps. 10 and 11-34-Pr.; tps. 9 to 12-1-2; tps. 9 to 13-2-2; tps. 8, 9, 11, 12, 16, and 17-3-2; tp. 9-4-2.

Subdivision in tp. 17-3-2; tp. 17-4-2; tps. 20 and 21-18-2.

Read, H. E., Calgary, Alberta—

Levelling north and east outlines of tps. 49 to 51, and 53 to 55-16-4; tps. 49 to 51, and 53 to 55-17-4; tps. 47, 49, 50, and 53 to 55-18-4; tps. 47, 49 to 51, and 53 to 55-19-4; tps. 41, 50, 51, and 53 to 55-20-4; tps. 47, 49, 51, and 54-21-4.

North outlines of tps. 46 and 51-18-4; tp. 46-19-4; tp. 46-20-4; tps. 46 and 50-21-4; tps. 46, 47, and 54-22-4.

East outlines of tp. 52-16-4; tp. 52-17-4; tps. 48 and 52-19-4; tps. 48, 49, and 52-20-4; tps. 48, 52 and 55-21-4; tps. 48 to 52-22-4; tp. 47-23-4.

Russell, J., Edmonton, Alberta—

Levelling along north and east outlines of tps. 35 to 38-14-2; tps. 35 to 39-15-2.

North outlines of tps. 34 to 39-13-2; tps. 34 to 39-14-2; tp. 34-15-2.

East outlines of tps. 35 to 39-16-2.

Scott, W. A., Galt, Ontario (died August 12, 1919)—

Topographical mapping surveys for the revision of the Medicine Hat sectional sheet, comprising townships 9 to 16, ranges 1 to 15 west of the Fourth meridian.

Retracement survey in tp. 8-11-4.

Seibert, F. V., Edmonton, Alberta—

Subdivision of tps. 89 and 90-22-5.

Part subdivision of tp. 89-23-5; tp. 88-24-5.

Stadia surveys in tp. 89-24-5.

Soars, H. M. R., Edmonton, Alberta—

Stadia surveys in tps. 56 and 58 to 60-9-4; tps. 55, 56, and 58 to 60-10-4; tps. 55 to 61-11-4; tps. 55 to 59-12-4; tps. 57 to 59-13-4; tps. 57 to 59-14-4; tps. 59 and 60-15-4; tps. 59 and 60-16-4; tps. 59 and 60-17-4; tp. 60-18-4; tps. 59 and 60-19-4; tps. 59 and 60-20-4; tps. 59 and 60-21-4.

Traverse of Sturgeon river through tps. 54 and 55-24-4; tp. 54-25-4; tp. 54-26-4; tps. 54 and 55-27-4.



11 GEORGE V, A. 1921

Stewart, N. C., Vancouver, British Columbia—

Part subdivision of tps. 19 and 20-6-5; tp. 42-8-5; tp. 40-12-5; tp. 40-13-5; tp. 39-17-5; tp. 45-18-5; tp. 42-19-5; tps. 47 and 48-25-5.

Taggart, C. H., Kamloops, British Columbia—

Retracement of school lands in tp. 14-3-E; tp. 15-5-E; tps. 7 and 8-6-Pr.; tps. 7, 8, 9, 10 and 11-7-Pr.; tps. 8, 9, and 11-8-Pr.; tps. 10 and 11-9-Pr.; tp. 8-11-Pr.

Retracement in tp. 17-7-E; tp. 15A-11A-E; tp. 21-31-Pr.

Vicars, John, Kamloops, British Columbia—

Subdivision surveys in tps. 17 and 18-11-6; tps. 22 and 23-12-6; tp. 20-13-6; tps. 20 and 21-16-6; tp. 19-19-6; tp. 15-26-6.

Traverse in tp. 17-11-6; tp. 23-12-6; tp. 20-16-6; tp. 19-19-6.

Retracement in tp. 23-12-6; tps. 20 and 21-16-6; tp. 19-19-6; tp. 15-26-6.

Waugh, B. W., Ottawa, Ontario—

Stadia surveys in tps. 23 to 25-10-E; tps. 23 to 25-11-E; tps. 23 to 25-12-E; tps. 23 and 24-13-E; tps. 21 to 23-14-E; tps. 22 to 24-15-E; tps. 21 to 24-16-E; tp. 22-17-E; tp. 23-3-Pr.; tps. 24 and 25-4-Pr.; tps. 24 and 25-5-Pr.; tps. 23 and 24-7-Pr.; tps. 23 to 28-8-Pr.; tps. 23 to 27, 29 and 30-9-Pr.; tps. 22 to 30-10-Pr.

Investigation in tp. 22-6-Pr.

Walker, C. M., Banff, Alberta—

Retracement of school lands in tps. 31 and 32-23-4; tps. 29 to 32-24-4; tp. 29 to 32-25-4; tps. 29 to 32-26-4; tps. 31 and 32-27-4; tps. 30 to 32-28-4; tps. 31 and 32-29-4; tps. 30 to 32-1-5; tps. 30 to 32-2-5; tps. 30 to 32-3-5; tp. 32-4-5.

Stadia traverse in tps. 26 and 27-6-5; tps. 26 and 27-7-5; tp. 20-28-4; tp. 20-29-4.

Subdivision in tp. 13-4-5.



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## APPENDIX No. 3

SCHEDULE showing for each surveyor employed the number of miles surveyed of section lines, township outlines, traverses of lakes and rivers, and resurvey; also the cost of the same. Surveyors whose work cannot be reckoned in miles are omitted from the statement.

	Miles of Section	Miles of Outline	Miles of Traverse	Miles of Resurvey	Total Mile- age	Total Cost	Cost per Mile
Bennett, G. A.....			316		316	7,401 79	23.42
*Blanchet, G. H.....			1,408		1408	11,988 37	8.51
*Bowman, E.P.....	117	13	72	146	348	19,995 93	57.46
Buchanan, J. A.....	16	5	6	100	127	6,240 54	49.14
Coté, J. M.....			2	157	159	5,517 07	34.70
Cowper, G. C.....			210	24	234	7,590 68	32.44
*Cumming, A. L.....	63		106	92	261	20,112 37	77.06
Evans, S. L.....	277	26	160	18	481	14,485 68	30.12
Fontaine, L. E.....				140	140	5,209 09	37.21
*Jackson, J. E.....	158	28	33	134	353	20,980 07	59.43
King, J. A. S.....	199	15	152		366	15,656 12	42.78
Knight, R. H.....	160	13	22	3	198	14,534 66	73.41
LeBlanc, P. M. H.....			815		815	7,325 68	8.99
McGarry, P. J.....			488	17	505	7,631 40	15.11
McKay, R. B.....			28	167	195	6,932 11	35.55
*Norrish, W. H.....			476		476	9,185 30	19.30
Pearson, H. E.....			8	100	108	4,275 59	39.59
Plunkett, T. H.....	11		500	7	518	11,567 99	22.33
Rinfret, C.....	97		106	13	216	9,054 95	41.92
*Seibert, F. V.....	177	14	5	1	197	16,744 54	85.00
Soars, H. M. R.....			515	17	532	7,730 41	14.53
Stewart, N. C.....	99	17	36	2	154	13,733 75	89.18
Taggart, C. H.....			4	144	148	5,578 28	37.69
Walker, C. M.....	2		60	229	291	5,133 31	17.64
Waugh, B. W.....			855	1	856	9,134 63	10.67
	1,376	131	6,383	1,512	9,402	263,740 31	28.05

\*Spent part of season on special work which cannot be reckoned in miles. Total cost includes depreciation of outfit.

## APPENDIX No. 4

## DETAILS OF OFFICE WORK

Sketches, maps, and tracings.....	4587
Descriptions of irregular parcels of land.....	27
Returns of survey examined—	
Township subdivision.....	61
Stadia plots.....	710
Townships investigated for water areas.....	504
Road plans.....	636
Railway plans.....	50
Mineral claim plans.....	218
Correction and other miscellaneous surveys.....	238
Preliminary township plans.....	130
Township and miscellaneous plans compiled.....	824
Township and miscellaneous plans issued.....	835
Sectional maps issued (three miles to one inch)—	
New maps.....	3
Revised maps.....	8
Photographic work—	
Dry plates and films.....	1422
Contact prints.....	6887
Vandyke prints.....	370
Bromide enlargements.....	1237
Prints mounted.....	2908
Lantern slides.....	57
Wet plate process negatives.....	2588
Photo-litho plates.....	1014
Blueprints.....	2123



APPENDIX No. 5

SURVEYING INSTRUMENTS ON HAND MARCH 31, 1920

Instruments	In Stock April, 1 1919	Purchased	Balance			Remarks
			Sold	Loan	Store	
Abney levels.....	19	9	7	2	19	
Alidades.....	1				1	
Alt-azimuths.....	1				1	
Aneroids.....	91	19		5	103	2 struck off.
Artificial horizons.....	4				4	
Base line apparatus.....	1				1	
Cameras.....	18	6		5	19	
Chronometers and sidereal watches.....	53	5	3		55	
Compasses.....	38	36		3	68	3 lost on survey.
Current meters and logs.....	3				3	
Dip circles.....	2				2	
Field glasses and binoculars.....	6			1	5	
Levels.....	51	2		9	44	
Levelling rods.....	103			17	70	16 struck off.
Micrometer telescopes.....	8				8	
Optical squares.....	1				1	
Odometers.....		5			5	
Pedometers.....	16			1	15	
Photo-theodolites.....	5				5	
Plane tables.....	1				1	
Protractors.....	71			14	56	1 lost on survey.
Rod levels.....	31				29	2 lost on survey.
Sextants and reflecting circles..	3				3	
Solar compasses.....	2				2	
Stadia slide rules.....	60			6	54	
Stadia rods.....	26	33	17		42	
Steel tapes.....	160	7	29	9	123	6 struck off.
Subsidiary standard measures..	68		8	1	59	
Survey pickets.....	2				2	
Surveying cameras.....	4				4	
Tally registers.....	17	42		8	43	8 struck off.
Tape stretching apparatus.....	1					1 struck off.
Telemeters.....	1					1 struck off.
Thermometers.....	43	5	19	4	25	
Transit theodolites.....	66	5	11	7	53	
Zenith telescopes.....	1				1	